

1 20.GR8
2 **ILLUMINATION, TRAFFIC SIGNAL SYSTEMS, AND ELECTRICAL**
3
4 FMDESC.DT1
5 **Description**
6 Section 8-20.1 is supplemented with the following:
7
8 (*****)
9 \$\$1\$\$
10
11 GEMAT.DT1
12 **Materials**
13
14 FMAT.DT1
15 Section 8-20.2 is supplemented with the following:
16
17 **(NWR April 11, 2001)**
18 **Contracting Agency-Supplied Materials**
19 The Contracting Agency will supply the following materials for the \$\$1\$\$ system:
20
21

<u>Description</u>	<u>Quantity</u>
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23

\$\$2\$\$	
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24
25 Except for anchor bolts, the Contractor may request release of Contracting Agency-
26 supplied materials only after foundations for the equipment described above have
27 cured.
28
29 The Contractor shall notify the Engineer three working days in advance of the date
30 Contracting Agency-supplied materials are required.
31
32 Contracting Agency-supplied materials, except for the signal controller(s), will be
33 available for pick up, dimensional or bolt pattern verification during normal working
34 hours from the Region Signal Maintenance Office located at:
35
36 3700 - 9th Ave. S.
37 Seattle, WA 98134
38 Attention: Ms. B.J. Bely-Muraglia
39 Telephone: (206) 764-4014
40
41 200201.GR8
42 **Equipment List And Drawings**
43 Section 8-20.2(1) is supplemented with the following:
44
45 GMMANU.DT1
46 (NWR November 13, 1996)
47 Manufacturer's data for materials proposed for use in the contract which require
48 approval shall be submitted in one complete package.
49
50 GMPLAN.DT1
51 (NWR April 19, 1995)

1 Pole base to light source distances (H1) for lighting standards with pre-approved
2 plans shall be as noted in the Plans.
3
4 **GMENGR.DT1**
5 (NWR April 19, 1995)
6 Pole base to light source distances (H1) for lighting standards with pre-approved
7 plans will be determined or verified by the Engineer at the request of the Contractor
8 prior to fabrication.
9
10 **GMWOPP.DT1**
11 (NWR April 19, 1995)
12 Pole base to light source distances (H1) for lighting standards without pre-approved
13 plans will be furnished by the Engineer as part of the final approved shop drawings,
14 prior to fabrication.
15
16 **2002013.GR8**
17 (March 13, 1995)
18 If traffic signal standards, strain pole standards, or combination traffic signal and
19 lighting standards are required, final verified dimensions including pole base to
20 signal mast arm connection point, pole base to light source distances (H1), mast
21 arm length, offset distances to mast arm mounted appurtenances, and orientations
22 of pole mounted appurtenances will be furnished by the Engineer as part of the
23 final approved shop drawings prior to fabrication.
24
25 **GMSURV.DT1**
26 (NWR June 6, 1996)
27 If traffic signal standards, strain pole standards, or combination traffic signal and
28 lighting standards are proposed, final verified dimensions including pole base to
29 signal mast arm connection point, pole base to light source distances (H1), mast
30 arm length, offset distances to mast arm mounted appurtenances, and orientations
31 of pole mounted appurtenances will be furnished by the Engineer as part of the
32 final approved shop drawings prior to fabrication.
33
34 Final ground and roadway cross sections at the locations of the standards shall be
35 submitted for approval along with the shop drawings.
36
37 **GMCOND.DT1**
38 **(NWR December 16, 2002)**
39 **Conduit**
40 Section 9-29.1 is supplemented with the following:
41
42 PVC solvent cement shall be medium-bodied gray and shall meet ASTM D 2564
43 including note 8 (label to show pipe sizes for which the cement is recommended).
44
45 **GMCOAT.DT1**
46 **(NWR June 5, 2000)**
47 **Conduit Coatings**
48 Conduit fittings for steel conduit shall be coated with galvanizing repair paint in the
49 same manner as conduit couplings. Electroplated fittings are not allowed.
50

1 Steel conduit entering concrete shall be wrapped in 2-inch-wide pipe wrap tape with
2 a minimum 1-inch overlap for 12 inches on each side of the concrete face. Pipe
3 wrap tape shall be installed per the manufacturers recommendations.
4

5 GMLQT.DT1
6 **(NWR March 8, 2004)**
7 **Liquidtight Flexible Metallic Conduit**
8 Liquidtight flexible metallic conduit and associated couplings, connectors, and
9 fittings shall conform to Article 350 of the National Electric Code.
10

11 GMCASING.DT1
12 **(NWR August 5, 1996)**
13 **Steel Casing**
14 Casing pipe for conduit shall be steel and shall conform to ASTM A252 GR2 or 3.
15 The diameter shall be as specified in the Plans. The wall thickness shall be
16 adequate to withstand the forces to which it is subjected during installation. The
17 minimum allowable wall thickness shall be 0.375 inches.
18

19 GMDRILL.DT1
20 **(NWR December 20, 1999)**
21 **Directional Boring**
22 Drilling fluid used for directional boring shall be an inert mixture of water and
23 bentonite clay conforming to the drilling equipment manufacturer's
24 recommendations.
25

26 GMATTACH.DT1
27 **(NWR September 22, 2003)**
28 **Surface Mounting Conduit Attachment Components**
29 Unistrut type channel supports and fastening hardware components shall be
30 stainless steel. Conduit clamps shall be hot-dip, galvanized steel or stainless steel,
31 and shall be one piece, two bolt units with lock washers. The clamps shall be
32 attached to the unistrut type channel supports on both sides of the conduit with
33 bolts and associated hardware. The minimum distance between adjacent clamps
34 and between the clamp and the end of the unistrut type channel supports shall be
35 one inch. Unistrut type channel supports shall be installed with stops, which
36 prevent clamps from sliding out of the ends.
37

38 GMBBOX.DT1
39 **(NWR April 14, 2003)**
40 **Junction Boxes**
41 Section 9-29.2 is supplemented with the following:
42

43 **NEMA 4X Stainless Steel Junction Boxes**
44 NEMA 4X stainless steel junction boxes shall meet the following requirements:
45 Cover screws shall be stainless steel. Junction boxes installed on exterior of
46 structures shall have an external hinge. Junction boxes shall be labeled with the
47 appropriate designation. See Standard Plans for traffic signal system and
48 illumination system labeling. Communication system boxes shall be labeled in the
49 same manner, with the exception that the label shall be COMM.
50

Polyethylene drain tubes for junction boxes mounted in structures shall be 3/8-inch diameter with a wall thickness of 0.062 inches and shall be rated for a 110 psi working pressure at 73° F.

Type 4, 5 and 6 Junction Boxes

Type 4, 5 and 6 junction boxes shall meet the following requirements:

Concrete shall have a minimum compressive strength of 4000 psi. The steel frame and lid shall be painted with a shop applied, inorganic zinc primer in accordance with Section 6-07.3.

Material shall conform to the following:

Concrete	Section 6-02
Reinforcing Steel	Section 9-07
Lid	ASTM A786 diamond plate rolled from plate Complying with ASTM A572, Grade 50 or ASTM A588, both with min. CVN toughness of 20 ft-lb at 40 F
Frame and Stiffener Plates	ASTM A572, Grade 50 or ASTM A588, both with min. CVN toughness of 20 ft-lb at 40F
Handle	ASTM A36 steel
Anchors (studs)	Section 9-06.15
Bolts, Nuts, Washers	ASTM F593 or A193, type 304 or 316

The lid stiffener plates shall bear on the frame. Mill so that there is full even contact, around the perimeter, between the bearing seat and lid stiffener plates, after fabrication of the frame and lid. The bearing seat and lid perimeter bar shall be free from loose mill scale, burrs, dirt and other foreign debris that would prevent solid seating. Bolts and nuts shall be liberally coated with anti-seize compound. Bolts shall be installed snug tight. The bearing seat and lid perimeter bar shall be machined to allow a minimum of 75% of the bearing areas to be seated with a tolerance of 0.0 to 0.005 inches measured with a feeler gage. The bearing area percentage will be measured for each side of the lid as it bears on the frame.

Type 4, 5 and 6 junction boxes and lids shall have a vertical load strength of 46,000 pounds without permanent deformation and 60,000 pounds without failure.

For each type of junction box (type 4, 5 and 6) to be installed, the Contractor shall provide a certified test report, prepared by an independent testing lab, which documents results of testing done by the independent testing lab for the manufacturer. The test report shall certify that the boxes meet or exceed the loading requirements and shall document the results of the load test listed below. The independent testing lab shall be approved by the State Materials Engineer and shall be located within the State of Washington. Representatives of the State Materials Lab shall witness the test and sign the test report. The Contractor shall give the Engineer 30 days notice prior to testing. Three copies of the test report shall be provided to the Engineer prior to acceptance.

Boxes shall be load tested to 46,000 pounds and then to 60,000 pounds. The test load shall be applied in both longitudinal and transverse orientations. At each interval the test box shall be inspected for lid deformation, failure of the lid/frame

welds, vertical and horizontal displacement of the lid frame, cracks, and concrete spalling. The test load shall be applied uniformly through a 10 inch x 20 inch x 1 inch steel plate centered on the frame.

Junction boxes meeting the 46,000-pound requirement shall not exhibit any of the following deficiencies:

1. Permanent deformation of the lid or any impairment to the function of the lid.
2. Vertical or horizontal displacement of the lid frame.
3. Cracks wider than 0.012 inches that extend 12 inches or more.
4. Fracture or cracks passing through the entire thickness of the concrete.
5. Spalling of the concrete.

Junction boxes meeting the 60,000-pound requirement shall exhibit the following:

1. The lid is operational.
2. The lid is securely fastened.
3. The welds have not failed.
4. Permanent dishing or deformation of the lid is ¼ inch or less.
5. No buckling or collapse of the box.

GMWIR.DT1

Conductors, Cable

GM2CS.DT1

(NWR February 5, 2003)

In Section 9-29.3, Item 7 is revised to read as follows:

7. Two conductor shielded (2CS) cable shall have No. 14 AWG (minimum) conductors and shall conform to I.M.S.A. specification No. 50-2.

GMWIRS.DT1

Section 9-29.3 is supplemented with the following:

GMRLOOP.DT1

(NWR February 9, 2004)

In Section 9-29.3, Item 8 is revised to read as follows:

8. Detector loops shall use No. 14 AWG stranded copper conductors, and shall conform to IMSA Specification 51-7, with cross-linked polyethylene (XLPE) insulation encased in a polyethylene outer jacket (PE tube).

GMCCABLE.DT1

(NWR February 5, 1999)

Communication Cable

Communication cable shall be as specified in Section 9-29.3 Item 11, except it shall be 22 gauge, and the number of cable pairs shall be as shown in the Plans.

Aerial communication cable shall meet REA specification PE-38 and shall be 22 gauge. The number of cable pairs shall be as shown in the Plans.

1 GMCOAXI.DT1

2 (NWR December 3, 1998)

3 **Autoscope Coaxial Cable**

4 Autoscope coaxial cable from camera to junction box and within traffic control
5 cabinet shall be Belden 9259, all other autoscope coaxial cable shall be Belden
6 8281.

7
8 Belden 9259 cable shall be RG59/U CCTV coaxial cable with 22 ga. stranded bare
9 copper conductor (15 ohms/M nominal), cellular polyethylene insulating dielectric,
10 95 % bare copper braid shield, and black PVC outer covering. Runs shall be
11 continuous whenever possible. If connectors must be employed they shall be BNC
12 connectors recommended by the manufacturer. BNC plug connectors shall be
13 Amphenol 31-71008-1000 (ECPI P/N 44957P1), the associated crimping tool shall
14 be CTL-1 (ECPI P/N 33381P1). BNC jack connectors shall be Amphenol 31-
15 71009-RFX or 31-71009 (ECPI P/N 44954P1), the associated crimping tool shall be
16 CTL-1 (ECPI P/N 33381P1). BNC Insulated Bulk Head Adapters shall be
17 Amphenol 31-4803-75 (ECPI P/N 44956P1). BNC Barrel or Straight Adapter
18 Connectors shall be Amphenol 31-70019, Amphenol 31-71019, or Cambridge CP-
19 AD755 (ECPI P/N 44953P1). BNC T-Adapter (Jack-Plug-Jack) Connectors shall
20 be Amphenol 31-70036 or Cambridge CP-AD706 (ECPI P/N 44952P2).

21
22 Belden 8281 coaxial cable shall be 75 Ohm Coaxial Cable with 20 ga. solid bare
23 copper conductor (9.9 Ohms/M), solid polyethylene insulating dielectric, 96% (min)
24 tinned copper double braided shield, and black polyethylene outer covering. Runs
25 shall be continuous whenever possible. If connectors must be employed, they shall
26 be BNC plug connectors, Amphenol 31-71032 (ECPI P/N 44957P2).

27
28 20022.GR8

29 ***Light And Signal Standards***

30
31 GMSLSS.DT1

32 (NWR December 16, 2002)

33 Section 9-29.6(1), including the heading, is revised to read:

34
35 **Steel Light and Signal Standards**

36 Steel plates and shapes for light and signal standards shall conform to the
37 requirements of ASTM A 36. Shafts for light and signal standards, except Type
38 PPB signal standards, shall conform to ASTM A 572, Grade 50. Shafts and
39 caps for Type PPB signal standards, slipfitters for type PS, I, FB, and RM
40 signal standards, and all pipes shall conform to ASTM A 53, Grade B. Base
41 plates for light standards shall conform to ASTM A 572, Grade 50, except as
42 otherwise noted in the Standard plans for fixed base light standards. Base
43 plates for signal standards shall conform to ASTM A 36. Connecting bolts shall
44 conform to AASHTO M 164. Fasteners for handhole covers, bands on lighting
45 brackets, and conductor attachment brackets shall conform to ASTM F 593.

46
47 Light and signal standards shall be hot-dipped galvanized in accordance with
48 AASHTO M 111 and AASHTO M 232. Galvanized steel light and signal
49 standards shall not be painted.

50
51 Section 9-29.6(1)A is deleted.

FMSLSS.DT1

Decorative Light Standards

Section 9-29.6(1)A is replaced with the following:

\$\$\$

200221.GR8

(April 5, 2004)

Light Standards with Type 1 Luminaire Arms

Lighting standards shall be fabricated in conformance with the methods and materials specified on the pre-approved Plans listed below, provided the following requirements have been satisfied:

(a) Light source to pole base distance (H1) shall be as noted in the Plans. Verification of H1 distances by the Engineer, prior to fabrication, is not required. Fabrication tolerance shall be ± 6 inches.

(b) All other requirements of the Special Provisions have been satisfied.

<u>Pre-Approved Plan</u>	<u>Fabricator</u>	<u>Mounting Hgt.</u>
Drawing No. DB00654 Rev. A Sheets 1, 2 & 3	Valmont Ind. Inc.	30', 40' & 50'
Drawing No. W3721-1 Rev. A & W3721-2	Ameron Pole Prod. Div.	40' & 50'
Drawing No. NWS 3510 or NWS 3510B	Northwest Signal Supply Inc.	25', 30', 35', 40', 45' & 50'
Drawing WS-SL-01	American Pole Structures, Inc.	25', 30', 35', 40', 45', 50'
Drawing 71035-B7 Rev. 20 Sheets 1 & 2	Union Metal Corp.	40'
Drawing 71035-B6 Rev. 16 Sheets 1, 2 & 3	Union Metal Corp.	50'

200222.GR8

(April 5, 2004)

Light Standards with Type 1 Luminaire Arms

Lighting standards shall be fabricated in conformance with the methods and materials specified on the pre-approved plans listed below, provided the following requirements have been satisfied:

(a) Mounting heights shall be as specified in the Plans.

(b) Light source to pole base distances (H1) shall be determined or verified by the Engineer prior to fabrication. Fabrication tolerance shall be ± 6 inches.

(c) All other requirements of the Special Provisions have been satisfied.

<u>Pre-Approved Plan</u>	<u>Fabricator</u>	<u>Mounting Hgt.</u>
Drawing No. DB00654 Rev. A Sheets 1, 2 & 3	Valmont Ind. Inc.	30', 40' & 50'
Drawing No. W3721-1 Rev. A & W3721-2	Ameron Pole Prod. Div.	40' & 50'
Drawing No. NWS 3510 or NWS 3510B	Northwest Signal Supply Inc.	25', 30', 35', 40', 45' & 50'
Drawing WS-SL-01	American Pole Structures, Inc.	25', 30', 35', 40', 45', 50'
Drawing 71035-B7 Rev. 20 Sheets 1 & 2	Union Metal Corp.	40'
Drawing 71035-B6 Rev. 16 Sheets 1, 2 & 3	Union Metal Corp.	50'

200223.GR8

(April 5, 2004)

Light Standards with Type 2 Luminaire Arms

Lighting standards shall be fabricated in conformance with the methods and materials specified on the pre-approved plans listed below provided the following requirements have been satisfied:

- (a) Light source to pole base distance (H1) shall be as noted in the Plans. Verification of H1 distances by the Engineer, prior to fabrication, is not required. Fabrication tolerance shall be ± 6 inches.
- (b) All other requirements of the Special Provisions have been satisfied.

<u>Pre-Approved Plan</u>	<u>Fabricator</u>	<u>Mounting Hgt.</u>
Drawing No. W3720-1 & W3720-2	Ameron Pole Prod. Div.	40' and 50'
Drawing No. DB00653 Rev. A Sheets 1, 2 & 3	Valmont Ind. Inc.	30', 40' and 50'
Drawing No. NWS 3515 or NWS 3515B	Northwest Signal Supply Inc.	25', 30' 35' 40', 45', & 50'
Drawing No. WS-SL-02	American Pole Structures Inc.	25' to 50'
Drawing No. LD-10095 Rev. 20 Sheet 1 & 2	Union Metal Corp.	40'
Drawing No. LD-10100 Rev. 15 Sheet 1 & 2	Union Metal Corp.	50'

200224.GR8

(April 5, 2004)

Light Standards with Type 2 Luminaire Arms

Lighting standards shall be fabricated in conformance with the methods and materials specified on the pre-approved plans listed below, provided the following requirements have been satisfied:

- (a) Mounting heights shall be as specified in the Plans.
- (b) Light source to pole base distances (H1) shall be determined or verified by the Engineer prior to fabrication. Fabrication tolerance shall be ± 6 inches.
- (c) All other requirements of the Special Provisions have been satisfied.

<u>Pre-Approved Plan</u>	<u>Fabricator</u>	<u>Mounting Hgt.</u>
Drawing No. W3720-1 & W3720-2	Ameron Pole Prod. Div.	40' and 50'
Drawing No. DB00653 Rev. A Sheets 1, 2 & 3	Valmont Ind. Inc.	30', 40', and 50'
Drawing No. NWS 3515 or NWS 3515B	Northwest Signal Supply Inc.	25', 30', 35', 40', 45', & 50'
Drawing No. WS-SL-02	American Pole Structures Inc.	25' to 50'
Drawing No. LD-10095 Rev. 20 Sheets 1 & 2	Union Metal Corp.	40'
Drawing No. LD-10100 Rev. 15 Sheets 1 & 2	Union Metal Corp.	50'

GMLSTV.DT1

(NWR September 15, 2003)

Light Standards for Type V Fixtures

Light standards to support the Type V fixtures shall be fabricated as specified below and as detailed in the Plans.

The poles shall meet the requirements for the "No Mast Arm" light standard shown in Standard Plan J-1 and the following:

Luminaire Bracket Support Flange:

A flange to support a luminaire bracket shall be welded to the shaft in accordance with the detail in the Plans.

Pole Top Tenon and Luminaire Bracket:

The design shall include a pole top tenon and bracket assembly suitable for mounting two or three luminaire fixtures per pole. The rotatable assembly shall rest on the support flange and be anchored by means of set screws. The

1 removable pole cap shall be metal. Tenon geometries shall be as shown in the
2 Plans.
3
4 **Handhole:**
5 When mounted on the barrier, the handhole shall be located on the
6 downstream side.
7
8 **Base Details:**
9 Base details shall conform to Standard Plan J-1b. Bases may be fixed or slip,
10 as called for in the Plans.
11
12 **Median Barrier Installation:**
13 Base plates shall be modified to conform with the dimensions shown on
14 Standard Plan C-8b when poles are installed on median barrier.
15
16 **Approvals:**
17 Shop drawings shall be approved by the Engineer prior to pole fabrication.
18
19 FMDECS.DT1
20 (*****)
21 **Decorative Steel Light Standard**
22 \$\$1\$\$
23
24 200225.GR8
25 **(April 5, 2004)**
26 **Traffic Signal Standards**
27 Traffic signal standards shall be furnished and installed in accordance with the
28 methods and materials noted in the applicable Standard Plans, pre-approved plans,
29 or special design plans.
30
31 All welds shall comply with the latest AASHTO Standard Specifications for
32 Structural Supports for Highway Signs, Luminaires and Traffic Signals. Welding
33 inspection shall comply with Section 6-03.3(25)A Welding Inspection.
34
35 Hardened washers shall be used with all signal arm connecting bolts instead of
36 lockwashers. All signal arm AASHTO M 164 connecting bolts shall be tightened to
37 40 percent of proof load.
38
39 Traffic signal standard types and applicable characteristics are as follows:
40
41 Type PPB Pedestrian push button posts shall conform to Standard Plan J-
42 7a or to one of the following pre-approved plans:
43
44

<u>Fabricator</u>	<u>Drawing No.</u>
Northwest Signal Supply Inc.	NWS 3530 or NWS 3530B
Valmont Ind. Inc.	DB00655 Rev. B
Ameron Pole Prod. Div.	M3723 Rev. D

51
52

1	Type PS	Pedestrian signal standards shall conform to Standard Plan J-7a	
2		or to one of the following pre-approved plans:	
3			
4		<u>Fabricator</u>	<u>Drawing No.</u>
5		Northwest Signal	NWS 3530 or NWS 3530B
6		Supply Inc.	
7			
8		Valmont Ind. Inc.	DB00655 Rev. B
9			
10		Ameron Pole	M3723 Rev. D or W3539
11		Prod. Div.	
12			
13		Union Metal Corp.	TA-10025 Rev. 11
14			
15	Type I	Type I vehicle signal standards shall conform to Standard Plan J-	
16		7a or to one of the following pre-approved plans:	
17			
18		<u>Fabricator</u>	<u>Drawing No.</u>
19		Northwest Signal	NWS 3530 or NWS 3530B
20		Supply Inc.	
21			
22		Valmont Ind. Inc.	DB00655 Rev. B
23			
24		Ameron Pole	M3723 Rev. D or W3539
25		Prod. Div	
26			
27		Union Metal Corp.	TA-10025
28			Rev. 11
29			
30	Type FB	Type FB flashing beacon standard shall conform to Standard	
31		Plan J-7a or the following pre-approved plan:	
32			
33		<u>Fabricator</u>	<u>Drawing No.</u>
34		Union Metal Corp	50200-B58, Shts. 1 & 2
35			
36		Valmont Ind. Inc.	DB00655 Rev. B
37			
38		Ameron Pole	W3539 Rev. B
39		Prod. Div.	
40			
41		Northwest Signal	NWS 3535 or NWS 3535B
42		Supply, Inc.	
43			
44	Type RM	Type RM ramp meter standard shall conform to Standard Plan J-	
45		7a or the following pre-approved plan:	
46			
47		<u>Fabricator</u>	<u>Drawing No.</u>
48		Union Metal Corp	50200-B58, Shts. 1 & 2
49			
50		Valmont Ind. Inc.	DB00655 Rev. B
51			
52		Ameron Pole	W3539

1		Prod. Div.	
2			
3		Northwest Signal	NWS 3535 or NWS 3535B
4		Supply, Inc.	
5			
6	Type II	Characteristics:	
7			
8		Luminaire mounting height	N.A.
9		Luminaire arms	N.A.
10		Luminaire arm length	N.A.
11		Signal arms	One Only
12			
13		Type II standards shall conform to one of the following pre-	
14		approved plans, provided all other requirements noted herein	
15		have been satisfied. Maximum (x) (y) (z) signal arm loadings in	
16		cubic feet are noted after fabricator.	
17			
18		Signal Arm	
19		<u>Length (max)</u>	<u>Fabricator-(x) (y) (z)</u>
20			<u>Drawing No.</u>
21		65 ft.	Valmont Ind. Inc.-(2894)
22			DB00625-Rev. D,
23			Shts. 1, 2 & 3
24		65 ft.	Union Metal Corp. (2900)
25			71026-B86 Rev. 4
26			shts. 1, 2, & 3
27		65 ft.	Ameron Pole-(2900)
28			W3724-1 Rev. A &
29			Prod. Div. W3724-2 Rev. C
30		65 ft.	Northwest Signal-(2802)
31			NWS 3500 Rev. 10/14/03
32			Supply Inc. or NWS 3500B
33			Rev. 10/14/03
34		45 ft.	American Pole(1875)
35			WS-T2-L Rev. 1
36			Structures, Inc.
37		65 ft.	American Pole (2913)
38			WS-T2-H Rev. 1
39			Structures, Inc.
40	Type III	Characteristics:	
41			
42		Luminaire mounting height	30 ft.,
43			35 ft.,
44			40 ft.,
45			or 50 ft.
46		Luminaire arms	One Only
47		Luminaire arm type	Type 1
48		Luminaire arm length (max.)	16 ft.
49		Signal arms	One Only
50			
51		Type III standards shall conform to one of the following pre-	
52		approved plans, provided all other requirements noted herein	

1	have been satisfied. Maximum (x) (y) (z) signal arm loadings in		
2	cubic feet are noted after fabricator.		
3			
4	Signal Arm		
5	<u>Length (max)</u>	<u>Fabricator-(x) (y) (z)</u>	<u>Drawing No.</u>
6			
7	65 ft.	Valmont Ind. Inc.-(2947)	DB00625-Rev. D,
8			Shts. 1, 2 & 3
9			and "J" luminaire arm
10			
11	65 ft.	Union Metal Corp. (2900)	71026-B87 Rev. 4
12			Shts. 1, 2 & 3
13			
14	65 ft.	Ameron Pole-(2900)	W3724-1 Rev. A &
15		Prod. Div.	W3724-2 Rev. C
16			and "J" luminaire arm
17			
18	65 ft.	Northwest Signal-(2802)	NWS 3500 Rev. 10/14/03
19		Supply Inc.	or NWS 3500B
20			Rev. 10/14/03
21			
22	45 ft.	American Pole (1875)	WS-T3J-L, Rev. 1, Shts. 1 & 2
23		Structures, Inc.	
24			
25	65 ft.	American Pole (2913)	WS-T3J-H Rev. 1, Shts. 1 & 2
26		Structures, Inc.	
27			
28	Type IV	Type IV strain pole standards shall be consistent with details in	
29		the plans and Standard Plan J-7c or one of the following pre-	
30		approved plans:	
31			
32		<u>Fabricator</u>	<u>Drawing No.</u>
33		Northwest Signal	NWS 3520 or NWS 3520B,
34		Supply Inc.	
35			
36		Valmont Ind. Inc.	5000-4
37			
38		Ameron Pole	M3650 Rev. A
39		Prod. Div.	
40			
41		Union Metal Corp.	EA-10224 Rev. 6
42			
43		American Pole	9000-12-037 Rev. A
44		Structures, Inc.	
45			
46	Type V	Type V combination strain pole and lighting standards shall be	
47		consistent with details in the plans and Standard Plan J-7c or	
48		one of the following pre-approved plans:	
49			
50		<u>Fabricator</u>	<u>Drawing No.</u>
51		Northwest Signal	NWS 3520 or NWS 3520B
52		Supply Inc.	

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52

Valmont Ind. Inc. 5000-4

Ameron Pole M3650 Rev. A
Prod. Div.

Union Metal Corp. EA-10225, Rev. 6
Shts. 1 & 2

American Pole 9020-12-007 Rev. B
Structures, Inc.

The luminaire arm shall be Type 1, 16 foot maximum and the luminaire mounting height shall be 40 feet or 50 feet as noted in the plans.

Type SD

Type SD standards require special design. All special design shall be based on the latest AASHTO Standard Specifications for Structural Supports for Highway Signs, Luminaires and Traffic Signals and pre-approved plans and as follows:

1. A 90 mph wind loading shall be used.
2. The Design Life and Recurrence Interval shall be 50 years for luminaire support structures exceeding 50 feet in height, and 25 years for all other luminaire support structures.
3. Fatigue design shall conform to AASHTO Section 11, Table 11-1 using fatigue category III.

Complete calculations for structural design, including anchor bolt details, shall be prepared by a Professional Engineer, licensed under Title 18 RCW, State of Washington, in the branch of Civil or Structural Engineering or by an individual holding valid registration in another state as a civil or structural Engineer.

All shop drawings and the cover page of all calculation submittals shall carry the Professional Engineer's original signature, date of signature, original seal, registration number, and date of expiration. The cover page shall include the contract number, contract title, and sequential index to calculation page numbers. Two copies of the associated design calculations shall be submitted for approval along with shop drawings.

Details for handholes and luminaire arm connections are available from the Bridges and Structures Office.

Foundations for various types of standards shall be as follows:

Type PPB	As noted on Standard Plan J-7a.
Type PS	As noted on Standard Plan J-7a.

1	Type I	Type I vehicle signal standards shall conform to Standard Plan J-7a or to one of the following pre-approved plans:	
2			
3			
4		<u>Fabricator</u>	<u>Drawing No.</u>
5		Northwest Signal	NWS 3530 or NWS 3530B
6		Supply Inc.	
7			
8		Valmont Ind. Inc.	DB00655 Rev. B
9			
10		Ameron Pole	M3723 Rev. D or W3539
11		Prod. Div.	
12			
13		Union Metal Corp.	TA-10025 Rev. 11
14			
15	Type FB	Type FB flashing beacon standard shall conform to Standard Plan J-7a or the following pre-approved plan:	
16			
17			
18		<u>Fabricator</u>	<u>Drawing No.</u>
19		Valmont Ind. Inc.	DB00655 Rev. B
20			
21		Union Metal Corp.	50200-B58, Shts. 1 & 2
22			
23		Ameron Pole	W3539
24		Prod. Div.	
25			
26		Northwest Signal	NWS 3535 or NWS 3535B
27		Supply Inc.	
28			
29	Type RM	Type RM ramp meter standard shall conform to Standard Plan J-7a or the following pre-approved plan:	
30			
31			
32		<u>Fabricator</u>	<u>Drawing No.</u>
33		Valmont Ind. Inc.	DB00655 Rev. B
34			
35		Union Metal Corp.	50200-B58, Shts. 1 & 2
36			
37		Ameron Pole	W3539
38		Prod. Div.	
39			
40		Northwest Signal	NWS 3535 or NWS 3535B
41		Supply Inc.	
42			
43	Type II	Characteristics:	
44			
45		Luminaire mounting height	N.A.
46		Luminaire arms	N.A.
47		Luminaire arm length	N.A.
48		Signal arms	One Only
49			
50		Type II standards shall conform to one of the following pre-	
51		approved plans, provided all other requirements noted herein	

1	have been satisfied. Maximum (x) (y) (z) signal arm loadings in		
2	cubic feet are noted after fabricator.		
3			
4	Signal Arm		
5	<u>Length (max)</u>	<u>Fabricator-(x) (y) (z)</u>	<u>Drawing No.</u>
6			
7	60 ft.	Valmont Ind. Inc.-(2894)	DB00625-Rev. D,
8			Shts. 1, 2 & 3
9			
10	65 ft.	Union Metal Corp. (2900)	71026-B86 Rev. 4
11			Shts. 1, 2 & 3
12			
13	65 ft.	Ameron Pole-(2900)	W3724-1 Rev. A &
14			W3724-2 Rev. C
15			
16	65 ft.	Northwest Signal-(2802)	NWS 3505 Rev. 10/14/03
17		Supply Inc.	or NWS 3505B
18			Rev. 10/14/03
19			
20			
21	45 ft.	American Pole (1875)	WS-T2-L Rev. 1
22		Structures, Inc.	
23			
24	65 ft.	American Pole (2913)	WS-T2-H Rev. 1
25		Structures, Inc.	
26			
27	Type III	Characteristics:	
28			
29		Luminaire mounting height	30 ft., 35 ft.,
30			40 ft., or 50 ft.
31		Luminaire arms	One Only
32		Luminaire arm type	Type 2
33		Luminaire arm length (max.)	16 ft.
34		Signal arms	One Only
35			
36		Type III standards shall conform to one of the following pre-	
37		approved plans, provided all other requirements noted herein	
38		have been satisfied. Maximum (x) (y) (z) signal arm loadings in	
39		cubic feet are noted after fabricator.	
40			
41	Signal Arm		
42	<u>Length (max)</u>	<u>Fabricator-(x) (y) (z)</u>	<u>Drawing No.</u>
43			
44	65 ft.	Valmont Ind. Inc.-(2947)	DB00625-Rev. D,
45			Shts. 1, 2 & 3
46			and "T" luminaire arm
47			
48	65 ft.	Northwest Signal-(2802)	NWS 3505 Rev. 10/14/03 or
49		Supply Inc.	NWS 3505B Rev. 10/14/03
50			
51	65 ft.	Ameron Pole-(2900)	W3724-1 Rev. A &
52		Prod. Div.	W3724-2 Rev. C

1		and "T" luminaire arm
2		
3	Type IV	Type IV strain pole standards shall be consistent with details in
4		the Plans and Standard Plan J-7c or one of the following pre-
5		approved plans:
6		
7		<u>Fabricator</u> <u>Drawing No.</u>
8		Northwest Signal NWS 3525 or NWS 3525B
9		Supply Inc.
10		
11		Valmont Ind. Inc. 5000-4
12		
13		Ameron Pole M3650 Rev. A
14		Prod. Div.
15		
16		Union Metal Corp. EA-10224, Rev. 6
17		
18		American Pole 9000-12-037 Rev. A
19		Structures, Inc.
20		
21	Type V	Type V combination strain pole and lighting standards shall be
22		consistent with details in the Plans and Standard Plan J-7c or
23		one of the following pre-approved plans:
24		
25		<u>Fabricator</u> <u>Drawing No.</u>
26		Ameron Pole M3650 Rev. A
27		Prod. Div.
28		
29		Northwest Signal NWS 3525 or NWS 3525B
30		Supply Inc.
31		
32		American Pole 9020-12-007 Rev. B
33		Structures, Inc.
34		
35		The luminaire arm shall be Type 2, 16 foot maximum and the
36		luminaire mounting height shall be 40 feet or 50 feet as noted in
37		the Plans.
38		
39	Type SD	Type SD standards require special design. All special design
40		shall be based on the latest AASHTO Standard Specifications for
41		Structural Supports for Highway Signs, Luminaires and Traffic
42		Signals and pre-approved plans and as follows:
43		
44		1. A 90 mph wind loading shall be used.
45		
46		2. The Design Life and Recurrence Interval shall be 50
47		years for luminaire support structures exceeding 50 feet
48		in height, and 25 years for all other luminaire support
49		structures.
50		
51		3. Fatigue design shall conform to AASHTO Section 11,
52		Table 11-1 using fatigue category III.

1
2 Complete calculations for structural design, including anchor bolt
3 details, shall be prepared by a Professional Engineer, licensed
4 under Title 18 RCW, State of Washington, in the branch of Civil or
5 Structural Engineering or by an individual holding valid
6 registration in another state as a civil or structural Engineer.
7
8 All shop drawings and the cover page of all calculation submittals
9 shall carry the Professional Engineer's original signature, date of
10 signature, original seal, registration number, and date of
11 expiration. The cover page shall include the contract number,
12 contract title, and sequential index to calculation page numbers.
13 Two copies of the associated design calculations shall be
14 submitted for approval along with shop drawings.
15
16 Details for handholes and luminaire arm connections are
17 available from the Bridges and Structures Office.
18
19 Foundations for various types of standards shall be as follows:
20
21 Type PPB As noted on Standard Plan J-7a.
22 Type PS As noted on Standard Plan J-7a.
23 Type I As noted on Standard Plan J-7a.
24 Type FB As noted on Standard Plan J-7a.
25 Type RM As noted on Standard Plan J-7a.
26 Type II As noted in the Plans.
27 Type III As noted in the Plans.
28 Type IV As noted in the Plans and Standard Plan J-7c.
29 Type V As noted in the Plans and Standard Plan J-7c.
30 Type SD As noted in the Plans.
31
32 FMOUT.DT1
33 (*****)
34 **Electrical Outlet**
35 \$\$1\$\$
36
37 FMDECC.DT1
38 (*****)
39 **Decorative Concrete Lighting Standard**
40 \$\$1\$\$
41
42 FMTS.DT1
43 **Timber Light Standards, Timber Strain Poles, Timber Service Supports**
44 Section 9-29.6(3) is supplemented with the following:
45
46 (*****)
47 \$\$1\$\$
48
49 GMXF.DT1
50 **(NWR January 14, 2002)**
51 **Transformers**
52 Section 9-29.9 is supplemented with the following:

Transformers shall be 480/120 volt, single phase, indoor/outdoor type dry transformers rated as indicated in the Plans.

The transformer coils, buss bar, and all connections shall be copper.

Transformers rated 7.5 kva and above shall be fitted with taps to provide voltages that are 5% and 10% below normal full capacity.

GMLUMIN.DT1

(NWR September 16, 2002)

Luminaires

Section 9-29.10 is supplemented with the following:

Conventional highway luminaires shall be high-pressure sodium Type III medium cut-off.

The refractor or flat lens shall be mounted in a doorframe assembly, which shall be hinged to the luminaire and secured in the closed position to the luminaire by means of an automatic latch. The refractor or flat lens and doorframe assembly, when closed, shall exert pressure against a gasket seat. Gaskets shall be composed of material capable of withstanding temperatures involved and shall be securely held in place.

Sections 9-29.10(2), 9-29.10(3), and 9-29.10(4) are deleted.

FMTVF.DT1

(***)**

Type V Fixture

\$S1\$S

FMDEC.DT1

(***)**

Decorative Fixtures

\$S1\$S

GMXUD.DT1

(NWR November 26, 2001)

Underdeck Cutoff Fixture

Underdeck fixtures shall be wall mountable and shall be hose-down rated with a gasket between the doorframe and ballast housings and between the doorframe and lens. Housing shall be low copper alloy cast aluminum with gray paint finish. The luminaires down light efficiency shall be no less than 64% of lamp output, with peak candle power occurring at 65 to 70 degrees, using a heavy borosilicate prismatic glass lens with 180 degree beam spread. Lamps shall have HPF ballasts, per requirements of Section 9-29.9. Lamps shall be high-pressure sodium, with mogul base socket. Lens shall be vandal resistant. The luminaires shall have wire protective guards on the lenses. Fusing shall be provided for all conductors above ground potential.

1 GMMERC.DT1
2 **(NWR January 23, 1997)**
3 **Mercury Vapor Lamps**
4 Mercury vapor lamps for this project shall have a 24,000 hour rated life. When the
5 lamps are placed in luminaires, the support framework of the arc tube shall be in a
6 vertical plane.
7
8 GMVAPOR.DT1
9 **(NWR April 4, 1995)**
10 **High-Pressure Sodium Vapor Lamps**
11 High-pressure sodium vapor lamps for this project shall have a 24,000 hour rated
12 life.
13
14 GMHAL.DT1
15 **(NWR April 19, 1995)**
16 **Metal Halide Lamps**
17 Metal halide lamps used for this project shall have a 24,000-hour rated life.
18
19 The arc tube shall be within 15 degrees of horizontal when placed in a conventional
20 fixture. The arc tube shall be within 15 degrees of vertical when placed in a fixture
21 employing a vertical lamp socket. All lamps shall be rated for the orientation
22 required in this contract.
23
24 GMESM.DT1
25 ***Electrical Splice Materials***
26
27 GMAIRSPL.DT1
28 Section 9-29.12 is supplemented with the following:
29
30 **(NWR April 19, 1995)**
31 **Aerial Splice Enclosures**
32 Aerial splice enclosures shall meet the requirements of REA specification PE-52
33 and GTE Automatic Electric Specification GTS-8514. Aerial splice enclosures shall
34 be re-enterable and resealable without requiring special tools or equipment.
35 Conductor connections shall be sealed, moisture resistant telephone type
36 connectors approved for outside use. The cable shields shall be bonded using an
37 approved low resistance shield connector.
38
39 GMSPLICE.DT1
40 **(NWR March 29, 2004)**
41 **Illumination Circuit Splices**
42 Section 9-29.12(1) is supplemented with the following:
43
44 Temporary splices shall be the heat shrink type.
45
46 GMLOOPSPLE.DT1
47 **(NWR February 3, 2003)**
48 **Traffic Signal Splice Material**
49 Section 9-29.12(2) is revised to read:
50
51 Induction loop splices shall be either mastik type, or moisture resistant two way
52 heat shrink type meeting Mil Spec I-23053, or re-enterable type with semi-

1 hardening epoxy filling compound that remains semi-flexible enclosed in a re-
2 enterable rigid mold with end cap seals.
3
4 GMSIGCON.DT1
5 **Traffic Signal Controllers**
6
7 GMEMPRE.DT1
8 **Emergency Preemption**
9 Section 9-29.13(3) is supplemented with the following:
10
11 GMFCTL.DT1
12 **(NWR April 3, 1996)**
13 **Emergency Preemption Logic - NEMA**
14 The traffic signal controller shall have the capability of preempting normal
15 traffic signal operation.
16
17 The cabinet shall be wired to complement the controller and the preemption
18 hardware required in this contract.
19
20 The preemption logic shall be an internal software function of the traffic signal
21 controller.
22
23 The preemption system shall function as follows:
24
25 When a preemption call is registered for the phase or phases the
26 controller is presently serving, the controller shall remain in that phase
27 until this call is dropped.
28
29 When a preemption call is registered while the controller is serving a
30 vehicular or pedestrian phase other than the preemption phases called for,
31 a clearance interval (for pedestrians and vehicles) shall immediately be
32 timed. The controller shall then go to the emergency preemption phases
33 being called for, skipping all other vehicular and pedestrian calls whether
34 or not calls exist.
35
36 During any preemption phase, "Don't Walk" or "Hand Symbol" shall be
37 displayed on all pedestrian heads.
38
39 Upon termination of preemption operation, the controller shall be allowed
40 to sequence normally.
41
42 GMPRE.DT1
43 **(NWR June 7, 2004)**
44 **Preemption:**
45 The system shall be capable of preempting the controller to the phases shown
46 in the Plans when a signal is received from the field detector.
47
48 Pre-emption equipment shall be either Opticom or Tomar.
49
50 **Opticom**
51 If Opticom pre-emption equipment is used, the Contractor shall furnish
52 and install the following:

1. Pre-emption detectors shall be 3M Opticom Model 711.
2. Discriminators shall be four-channel model 454 units. One is required at each controller.

In addition, where auxiliary Opticom pre-emption is used, the Contractor shall furnish and install the following:

3. A 757 auxiliary optical detector wiring harness where more than one detector is called for per channel.
4. A twelve position terminal block of the barrier type rated for 20A at 600 volts RMS minimum and meeting the requirements of Chapter 11 of the Type 170 Hardware Specification, FHWA IP-78-16 as currently amended.

Tomar

Tomar equipment is allowed provided that it is able to receive and respond to Opticom emitter signals.

If Tomar equipment is used, the Contractor shall furnish and install the following:

1. Pre-emption detectors shall be Tomar Model 2090-SD complete with mount and mounting hardware.
2. Discriminators shall be Tomar Model 2080 four-channel units. One is required per controller.
3. The Contractor shall make all initial range adjustments.
4. The pre-emption function operation tests shall be performed using an Opticom emitter.

GMRIS.DT1

(NWR September 16, 2002)

Radio Interference Suppressers

Section 9-29.13(6) is supplemented with the following:

The interference filters shall be hermetically sealed in a substantial metal case filled with a suitable insulating compound.

GMHARD.DT1

(NWR November 16, 1995)

Emergency Preemption Hardwire:

Emergency preemption hardwire equipment installed by this contract shall activate the Emergency Preemption Logic in the traffic signal controller when a signal is received from a dry contact closure.

The contact closure shall be activated by a 120-volt input that is isolated from all controller circuitry.

1
2 The equipment used to provide the contact closure shall be housed in a
3 separate enclosure located within the controller cabinet.
4

5 FMTAC.DT1
6 **(NWR March 13, 1995)**
7 **Traffic Actuated Controllers**
8 Section 9-29.13(7) is supplemented with the following:
9

10 ***\$\$1\$\$*** control equipment shall be used in this contract.
11

12 GMNEMA.DT1
13 (NWR July 22, 1999)
14 The local signal control unit shall be a fully actuated, eight-phase controller.
15 Pedestrian functions on a minimum of four phases shall be provided.
16

17 The following functions shall also be provided in the local signal control unit:
18

19 1. Guaranteed Yellow
20 The Yellow interval for all phases shall be 3.5 seconds unless the
21 operator sets a higher value for it.
22

23 2. Simultaneous Gap Out
24 Two concurrently timing phases shall simultaneously reach a rest
25 state prior to their termination by gap out and prior to advancing
26 across the barrier. A phase in dual ring operation may re-time its gap
27 from a rest state upon vehicle actuation.
28

29 GMC170.DT1
30 (NWR April 1, 2002)
31 Type 170 traffic signal control equipment to be provided shall meet the
32 requirements given in this section and the California DOT Type 170 control
33 system hardware specification as currently amended.
34

35 The controller shall be a Model 170E or Model HC11-170E. The controller
36 shall be a quad ACIA unit.
37

38 PROM modules installed in Master controllers shall be model 412B2 or
39 Safetran 412C configured for use with the associated Wapiti W70SM software.
40

41 PROM modules installed in local controllers shall be model 412C and shall be
42 configured using Method 2 and Memory Select Option 4. The memory and
43 device mapping shall be as follows:
44

Chip Position	U1	U2	U3	U4
Address Range (HEX)	8000-FFFF	3000-4FFF	7010-7FFF	1000-2FFF
Device	27256	Dallas 1225	Dallas 1225	6264*

45
46
47
48
49
50 *Battery backup jumpering installed.
51

1	GMCWAPIT.DT1					
2	(NWR January 14, 1999)					
3	"CI" INPUT/OUTPUT FUNCTION ASSIGNMENTS					
4	PROGRAM WAPITI W4IKS					
5						
6	<u>PIN</u>	<u>I/O</u>	<u>Function</u>	<u>PIN</u>	<u>I/O</u>	<u>Function</u>
7						
8	1	****	logic ground	53	I2-7	ADV. ENABLE
9	2	01-1	4P DONT WALK	54	I2-8	
10	3	01-2	4P WALK	55	I3-1	5 EXTENSION & COUNT
11	4	01-3	4 RED	56	I3-2	1 EXTENSION & COUNT
12	5	01-4	4 YELLOW	57	I3-3	7 EXTENSION & COUNT
13	6	01-5	4 GREEN	58	I3-4	3 EXTENSION & COUNT
14	7	01-6	3 RED	59	I3-5	5 EXTENSION & COUNT
15	8	01-7	3 YELLOW	60	I3-6	1 EXTENSION & COUNT
16	9	01-8	3 GREEN	61	I3-7	7 EXTENSION & COUNT
17	10	02-1	2P DONT WALK	62	I3-8	3 EXTENSION & COUNT
18	11	02-2	2P WALK	63	I4-5	2 EXTENSION & COUNT
19	12	02-3	2 RED	64	I4-6	6 EXTENSION & COUNT
20	13	02-4	2 YELLOW	65	I4-7	4 EXTENSION & COUNT
21	14	* *	logic ground	66	I4-8	8 EXTENSION & COUNT
22	15	02-5	2 GREEN	67	I5-1	2 PEDESTRIAN PB
23	16	02-6	1 RED	68	I5-2	6 PEDESTRIAN PB
24	17	02-7	1 YELLOW	69	I5-3	4 PEDESTRIAN PB
25	18	02-8	1 GREEN	70	I5-4	8 PEDESTRIAN PB
26	19	03-1	8P DONT WALK	71	I5-5	EVA PREEMPT
27	20	03-2	8P WALK	72	I5-6	EVb PREEMPT
28	21	03-3	8 RED	73	I5-7	EVC PREEMPT
29	22	03-4	8 YELLOW	74	I5-8	EVD PREEMPT
30	23	03-5	8 GREEN	75	I6-1	
31	24	03-6	7 RED	76	I6-2	2 EXTENSION
32	25	03-7	7 YELLOW	77	I6-3	6 EXTENSION
33	26	03-8	7 GREEN	78	I6-4	4 EXTENSION
34	27	04-1	6P DONT WALK	79	I6-5	8 EXTENSION
35	28	04-2	6P WALK	80	I6-6	ADVANCE
36	29	04-3	6 RED	81	I6-7	FLASH SENSE
37	30	04-4	6 YELLOW	82	I6-8	STOP TIME
38	31	04-5	6 GREEN	83	06-1	3P DON'T WALK*
39	32	04-6	5 RED	84	06-2	3P WALK*
40	33	04-7	5 YELLOW	85	06-3	OLD RED*
41	34	04-8	5 GREEN	86	06-4	OLD YELLOW*
42	35	05-1	(A) TOD/DOW - OUTPUT	87	06-5	OLD GREEN*
43	36	05-2	(B) TOD/DOW - OUTPUT	88	06-6	OLC RED*
44	37	05-3	(C) TOD/DOW - OUTPUT	89	06-7	OLC YELLOW*
45	38	05-4	(D) TOD/DOW - OUTPUT	90	06-8	OLC GREEN*
46	39	I1-1	2 EXTENSION & COUNT	91	07-1	1 DON'T WALK*
47	40	I1-2	6 EXTENSION & COUNT	92	* *	logic ground*
48	41	I1-3	4 EXTENSION & COUNT	93	07-2	IP WALK*
49	42	I1-4	8 EXTENSION & COUNT	94	07-3	OLB RED*
50	43	I1-5	2 EXTENSION & COUNT	95	07-4	OLB YELLOW*
51	44	I1-6	6 EXTENSION & COUNT	96	07-5	OLB GREEN*
52	45	I1-7	4 EXTENSION & COUNT	97	07-6	OLA RED*

1	46	I1-8	8 EXTENSION & COUNT	98	07-7	OLA YELLOW*
2	47	I2-1	2 CALL DETECTOR	99	07-8	OLA GREEN*
3	48	I2-2	6 CALL DETECTOR	100	05-8	
4	49	I2-3	4 CALL DETECTOR	101	05-6	
5	50	I2-4	8 CALL DETECTOR	102	05-7	FLASH OUTPUT
6	51	I2-5	RRI (PED INHIBIT)	103	05-8	WATCHDOG
7	52	I2-6	RR2 (RAILROAD) 104	**		logic ground

8
9 GMC139.DT1
10 (NWR March 13, 1995)
11 "C" INPUT/OUTPUT FUNCTION ASSIGNMENTS
12 PROGRAM 139 JUNE 83
13

PIN	I/O	Function	PIN	I/O	Function
1	****	logic ground	53	I2-7	ADVANCE ENABLE
2	01-1	4P DONT WALK	54	I2-8	SPARE 2
3	01-2	4P WALK	55	I3-1	5 EXTENSION & COUNT
4	01-3	4 RED	56	I3-2	1 EXTENSION & COUNT
5	01-4	4 YELLOW	57	I3-3	7 EXTENSION & COUNT
6	01-5	4 GREEN	58	I3-4	3 EXTENSION & COUNT
7	01-6	3 RED	59	I3-5	SYSTEM DET 3
8	01-7	3 YELLOW	60	I3-6	SYSTEM DET 1
9	01-8	3 GREEN	61	I3-7	SYSTEM DET 4
10	02-1	2P DONT WALK	62	I3-8	SYSTEM DET 2
11	02-2	2P WALK	63	I4-5	2 EXTENSION & COUNT
12	02-3	2 RED	64	I4-6	6 EXTENSION & COUNT
13	02-4	2 YELLOW	65	I4-7	4 EXTENSION & COUNT
14	**	logic ground	66	I4-8	8 EXTENSION & COUNT
15	02-5	2 GREEN	67	I5-1	2 PEDESTRIAN PB
16	02-6	1 RED	68	I5-2	6 PEDESTRIAN PB
17	02-7	1 YELLOW	69	I5-3	4 PEDESTRIAN PB
18	02-8	1 GREEN	70	I5-4	8 PEDESTRIAN PB
19	03-1	8P DONT WALK	71	I5-5	EVA PREEMPT
20	03-2	8P WALK	72	I5-6	EVb PREEMPT
21	03-3	8 RED	73	I5-7	EVC PREEMPT
22	03-4	8 YELLOW	74	I5-8	EVD PREEMPT
23	03-5	8 GREEN	75	I6-1	SPARE 3
24	03-6	7 RED	76	I6-2	2 CALL
25	03-7	7 YELLOW	77	I6-3	6 CALL
26	03-8	7 GREEN	78	I6-4	4 CALL
27	04-1	6P DONT WALK	79	I6-5	8 CALL
28	04-2	6P WALK	80	I6-6	ADVANCE
29	04-3	6 RED	81	I6-7	FLASH SENSE
30	04-4	6 YELLOW	82	I6-8	STOP TIME
31	04-5	6 GREEN	83	06-1	reserved
32	04-6	5 RED	84	06-2	reserved
33	04-7	5 YELLOW	85	06-3	OVERLAP D RED
34	04-8	5 GREEN	86	06-4	OVERLAP D YEL
35	05-1	PREEMPT BEACON EVA	87	06-5	OVERLAP D YEL
36	05-2	PREEMPT BEACON EVC	88	06-6	OVERLAP D GRN
37	05-3	PREEMPT BEACON EVb	89	06-7	OVERLAPCD RED

1	38	05-4	PREEMPT BEACON EVD	90	06-8	OVERLAP C GRN
2	39	I1-1	2 EXTENSION & COUNT	91	07-1	RESERVED
3	40	I1-2	6 EXTENSION & COUNT	92	**	logic ground
4	41	I1-3	4 EXTENSION & COUNT	93	07-2	RESERVED
5	42	I1-4	8 EXTENSION & COUNT	94	07-3	OVERLAP B RED
6	43	I1-5	2 EXTENSION & COUNT	95	07-4	OVERLAP B YEL
7	44	I1-6	6 EXTENSION & COUNT	96	07-5	OVERLAP B GRN
8	45	I1-7	4 EXTENSION & COUNT	97	07-6	OVERLAP A RED
9	46	I1-8	8 EXTENSION & COUNT	98	07-7	OVERLAP A YEL
10	47	I2-1	2 CALL DETECTOR	99	07-8	OVERLAP A GRN
11	48	I2-2	6 CALL DETECTOR	100	05-5	reserved
12	49	I2-3	4 CALL DETECTOR	101	05-6	FLASH OUTPUT
13	50	I2-4	8 CALL DETECTOR	102	05-7	reserved
14	51	I2-5	RRI (CLR FLASH)	103	05-8	WATCHDOG
15	52	I2-6	RR2 (CLR-LIMITED SERV)	104	**	logic ground

16

17 GMC239.DT1

18 (NWR April 1, 1996)

19 "CI" INPUT/OUTPUT FUNCTION ASSIGNMENTS

20 PROGRAM 239 JULY 91

21

PIN	I/O	Function	PIN	I/O	Function
22					
23					
24	1	****	53	I2-7	
25	2	01-1	54	I2-8	
26	3	01-2	55	I3-1	5 EXTENSION & COUNT
27	4	01-3	56	I3-2	1 EXTENSION & COUNT
28	5	01-4	57	I3-3	7 EXTENSION & COUNT
29	6	01-5	58	I3-4	3 EXTENSION & COUNT
30	7	01-6	59	I3-5	
31	8	01-7	60	I3-6	
32	9	01-8	61	I3-7	
33	10	02-1	62	I3-8	
34	11	02-2	63	I4-5	2 EXTENSION & COUNT
35	12	02-3	64	I4-6	6 EXTENSION & COUNT
36	13	02-4	65	I4-7	4 EXTENSION & COUNT
37	14	**	66	I4-8	8 EXTENSION & COUNT
38	15	02-5	67	I5-1	2 PEDESTRIAN PB
39	16	02-6	68	I5-2	6 PEDESTRIAN PB
40	17	02-7	69	I5-3	4 PEDESTRIAN PB
41	18	02-8	70	I5-4	8 PEDESTRIAN PB
42	19	03-1	71	I5-5	EVA PREEMPT
43	20	03-2	72	I5-6	EVb PREEMPT
44	21	03-3	73	I5-7	EVC PREEMPT
45	22	03-4	74	I5-8	EVD PREEMPT
46	23	03-5	75	I6-1	
47	24	03-6	76	I6-2	2 EXTENSION
48	25	03-7	77	I6-3	6 EXTENSION
49	26	03-8	78	I6-4	4 EXTENSION
50	27	04-1	79	I6-5	8 EXTENSION
51	28	04-2	80	I6-6	
52	29	04-3	81	I6-7	FLASH SENSE

1	30	04-4	6 YELLOW	82	I6-8	STOP TIME
2	31	04-5	6 GREEN	83	06-1	reserved
3	32	04-6	5 RED	84	06-2	reserved
4	33	04-7	5 YELLOW	85	06-3	
5	34	04-8	5 GREEN	86	06-4	
6	35	05-1		87	06-5	
7	36	05-2		88	06-6	
8	37	05-3		89	06-7	
9	38	05-4		90	06-8	
10	39	I1-1	2 EXTENSION & COUNT	91	07-1	
11	40	I1-2	6 EXTENSION & COUNT	92	* *	logic ground
12	41	I1-3	4 EXTENSION & COUNT	93	07-2	
13	42	I1-4	8 EXTENSION & COUNT	94	07-3	
14	43	I1-5	2 EXTENSION & COUNT	95	07-4	
15	44	I1-6	6 EXTENSION & COUNT	96	07-5	
16	45	I1-7	4 EXTENSION & COUNT	97	07-6	
17	46	I1-8	8 EXTENSION & COUNT	98	07-7	
18	47	I2-1	2 CALL DETECTOR	99	07-8	
19	48	I2-2	6 CALL DETECTOR	100	05-8	
20	49	I2-3	4 CALL DETECTOR	101	05-6	FLASH OUTPUT
21	50	I2-4	8 CALL DETECTOR	102	05-7	
22	51	I2-5	RRI (CLR-FLASH)	103	05-8	WATCHDOG
23	52	I2-6	RR2 (CLR-LIMITED SERV)	104	* *	logic ground

24
25 GMC200.DT1
26 (NWR March 13, 1995)
27 "CI" INPUT/OUTPUT FUNCTION ASSIGNMENTS
28 PROGRAM 200 JULY 94
29

PIN	I/O	Function	PIN	I/O	Function
31					
32	1	****	53	I2-7	ADVANCE ENABLE
33		logic ground			(ALARM 1)
34	2	01-1	54	I2-8	[ALARM 2] (DIAL 2
35		4P DONT WALK			INPUT)
36	3	01-2	55	I3-1	5 EXTENSION & COUNT
37	4	01-3	56	I3-2	1 EXTENSION & COUNT
38	5	01-4	57	I3-3	7 EXTENSION & COUNT
39	6	01-5	58	I3-4	3 EXTENSION & COUNT
40	7	01-6	59	I3-5	5 EXT & CNT (OFFSET 2)
41		3 RED			(CNA)
42	8	01-7	60	I3-6	1 EXT & CNT (FREE)
43		3 YELLOW			(FLASH)
44	9	01-8	61	I3-7	7 EXT & CNT (OFFSET 3)
45		3 GREEN			(HOLD)
46	10	02-1	62	I3-8	3 EXT & CNT (OFF 1)
47		2P DONT WALK			(MINRCL)
48	11	02-2	63	I4-5	2 EXTENSION & COUNT
49	12	02-3	64	I4-6	6 EXTENSION & COUNT
50	13	02-4	65	I4-7	4 EXTENSION & COUNT
51	14	* *	66	I4-8	8 EXTENSION & COUNT
52	15	02-5	67	I5-1	2 PEDESTRIAN PB
		2 GREEN			

1	16	02-6	1 RED	68	I5-2	6 PEDESTRIAN PB
2	17	02-7	1 YELLOW	69	I5-3	4 PEDESTRIAN PB
3	18	02-8	1 GREEN	70	I5-4	8 PEDESTRIAN PB
4	19	03-1	8P DONT WALK	71	I5-5	EVA PREEMPT
5	20	03-2	8P WALK	72	I5-6	EVB PREEMPT
6	21	03-3	8 RED	73	I5-7	EVC PREEMPT
7	22	03-4	8 YELLOW	74	I5-8	EVD PREEMPT
8	23	03-5	8 GREEN	75	I6-1	(DIAL 3 INPUT)
9	24	03-6	7 RED	76	I6-2	2 EXTENSION
10	25	03-7	7 YELLOW	77	I6-3	6 EXTENSION
11	26	03-8	7 GREEN	78	I6-4	4 EXTENSION
12	27	04-1	6P DONT WALK	79	I6-5	8 EXTENSION (MAX INH2)
13	28	04-2	6P WALK	80	I6-6	ADVANCE
14	29	04-3	6 RED	81	I6-7	FLASH SENSE
15	30	04-4	6 YELLOW	82	I6-8	STOP TIME
16	31	04-5	6 GREEN	83	06-1	reserved
17	32	04-6	5 RED	84	06-2	reserved
18	33	04-7	5 YELLOW	85	06-3	OVERLAP D RED (FREE/ FLASH)
19						
20	34	04-8	5 GREEN	86	06-4	OVERLAP D YEL (D2 OUTPUT)
21						
22	35	05-1	MULTIFUNCTION OUT1	87	06-5	OVERLAP D GRN (D3 OUTPUT)
23						
24	36	05-2	MULTIFUNCTION OUT2	88	06-6	OVERLAP C RED (01 OUTPUT)
25						
26	37	05-3	MULTIFUNCTION OUT3	89	06-7	OVERLAP C YEL (02 OUTPUT)
27						
28	38	05-4	MULTIFUNCTION OUT4	90	06-8	OVERLAP C GRN (03 OUTPUT)
29						
30	39	I1-I	2 EXTENSION & COUNT	91	07-1	reserved
31	40	I1-2	6 EXTENSION & COUNT	92	* *	logic ground
32	41	I1-3	4 EXTENSION & COUNT	93	07-2	reserved
33	42	I1-4	8 EXTENSION & COUNT	94	07-3	OVERLAP B RED
34	43	I1-5	2 EXTENSION & COUNT	95	07-4	OVERLAP B YEL
35	44	I1-6	6 EXTENSION & COUNT	96	07-5	OVERLAP B GRN
36	45	I1-7	4 EXTENSION & COUNT	97	07-6	OVERLAP A RED
37	46	I1-8	8 EXTENSION & COUNT	98	07-7	OVERLAP A YEL
38	47	I2-1	2 CALL DETECTOR	99	07-8	OVERLAP A GRN
39	48	I2-2	6 CALL DETECTOR	100	05-8	reserved
40	49	I2-3	4 CALL DETECTOR	101	05-6	CABINET FLASH OUTPUT
41	50	I2-4	8 CALL DETECTOR	102	05-7	DETECTOR RESET
42	51	I2-5	RRI (CLR-FLASH)	103	05-8	WATCHDOG
43	52	I2-6	RR2 (CLR-LIMITED SERV)	104	* *	logic ground

GMC158.DT1

(NWR March 13, 1995)

"CI" INPUT/OUTPUT FUNCTION ASSIGNMENTS

PROGRAM 158 JULY 83

PIN	I/O	Function	PIN	I/O	Function
-----	-----	----------	-----	-----	----------

1	1	****	logic ground	53	I2-7	reserved
2	2	01-1	4P DONT WALK	54	I2-8	reserved
3	3	01-2	4P WALK	55	I3-1	5 EXTENSION & COUNT
4	4	01-3	4 RED	56	I3-2	1 EXTENSION & COUNT
5	5	01-4	4 YELLOW	57	I3-3	7 EXTENSION & COUNT
6	6	01-5	4 GREEN	58	I3-4	3 EXTENSION & COUNT
7	7	01-6	3 RED	59	I3-5	SYSTEM DET 3
8	8	01-7	3 YELLOW	60	I3-6	SYSTEM DET 1
9	9	01-8	3 GREEN	61	I3-7	SYSTEM DET 4
10	10	02-1	2P DONT WALK	62	I3-8	SYSTEM DET 2
11	11	02-2	2P WALK	63	I4-5	2 EXTENSION & COUNT
12	12	02-3	2 RED	64	I4-6	6 EXTENSION & COUNT
13	13	02-4	2 YELLOW	65	I4-7	4 EXTENSION & COUNT
14	14	* *	logic ground	66	I4-8	8 EXTENSION & COUNT
15	15	02-5	2 GREEN	67	I5-1	2 PEDESTRIAN PB
16	16	02-6	1 RED	68	I5-2	6 PEDESTRIAN PB
17	17	02-7	1 YELLOW	69	I5-3	4 PEDESTRIAN PB
18	18	02-8	1 GREEN	70	I5-4	8 PEDESTRIAN PB
19	19	03-1	8P DONT WALK	71	I5-5	EVA PREEMPT
20	20	03-2	8P WALK	72	I5-6	EVb PREEMPT
21	21	03-3	8 RED	73	I5-7	EVC PREEMPT
22	22	03-4	8 YELLOW	74	I5-8	EVD PREEMPT
23	23	03-5	8 GREEN	75	I6-1	reserved
24	24	03-6	7 RED	76	I6-2	2 EXTENSION
25	25	03-7	7 YELLOW	77	I6-3	6 EXTENSION
26	26	03-8	7 GREEN	78	I6-4	4 EXTENSION
27	27	04-1	6P DONT WALK	79	I6-5	8 EXTENSION
28	28	04-2	6P WALK	80	I6-6	reserved
29	29	04-3	6 RED	81	I6-7	FLASH SENSE
30	30	04-4	6 YELLOW	82	I6-8	STOP TIME
31	31	04-5	6 GREEN	83	06-1	reserved
32	32	04-6	5 RED	84	06-2	reserved
33	33	04-7	5 YELLOW	85	06-3	reserved
34	34	04-8	5 GREEN	86	06-4	reserved
35	35	05-1	PREEMPT BEACON EVA	87	06-5	reserved
36	36	05-2	PREEMPT BEACON EVC	88	06-6	reserved
37	37	05-3	PREEMPT BEACON EVb	89	06-7	reserved
38	38	05-4	PREEMPT BEACON EVD	90	06-8	reserved
39	39	II-I	2 EXTENSION & COUNT	91	07-1	reserved
40	40	I1-2	6 EXTENSION & COUNT	92	* *	logic ground
41	41	I1-3	4 EXTENSION & COUNT	93	07-2	reserved
42	42	I1-4	8 EXTENSION & COUNT	94	07-3	reserved
43	43	I1-5	2 EXTENSION & COUNT	95	07-4	reserved
44	44	I1-6	6 EXTENSION & COUNT	96	07-5	reserved
45	45	I1-7	4 EXTENSION & COUNT	97	07-6	reserved
46	46	I1-8	8 EXTENSION & COUNT	98	07-7	reserved
47	47	I2-1	2 CALL DETECTOR	99	07-8	reserved
48	48	I2-2	6 CALL DETECTOR	100	05-8	reserved
49	49	I2-3	4 CALL DETECTOR	101	05-6	reserved
50	50	I2-4	8 CALL DETECTOR	102	05-7	reserved
51	51	I2-5	RRI (CLR-FLASH)	103	05-8	WATCHDOG
52	52	I2-6	RR2 (CLR-LIMITED SERV)	104	* *	logic ground

1						
2			GMC173.DT1			
3			(NWR March 13, 1995)			
4			"C" INPUT/OUTPUT FUNCTION ASSIGNMENTS			
5			PROGRAM 173 DECEMBER 83			
6						
7			<u>PIN I/O Function</u>			<u>PIN I/O Function</u>
8						
9		1	**** logic ground	53	I2-7	ADVANCE ENABLE
10		2	01-1 4P DONT WALK	54	I2-8	SPARE 2
11		3	01-2 4P WALK	55	I3-1	5 EXTENSION & COUNT
12		4	01-3 4 RED	56	I3-2	1 EXTENSION & COUNT
13		5	01-4 4 YELLOW	57	I3-3	7 EXTENSION & COUNT
14		6	01-5 4 GREEN	58	I3-4	3 EXTENSION & COUNT
15		7	01-6 OVERLAP A RED	59	I3-5	SYSTEM DET 3
16		8	01-7 OVERLAP A YELLOW	60	I3-6	SYSTEM DET 1
17		9	01-8 OVERLAP A GREEN	61	I3-7	SYSTEM DET 4
18		10	02-1 2P DONT WALK	62	I3-8	SYSTEM DET 2
19		11	02-2 2P WALK	63	I4-5	2 EXTENSION & COUNT
20		12	02-3 2 RED	64	I4-6	6 EXTENSION & COUNT
21		13	02-4 2 YELLOW	65	I4-7	4 EXTENSION & COUNT
22		14	* * logic ground	66	I4-8	8 EXTENSION & COUNT
23		15	02-5 2 GREEN	67	I5-1	2 PEDESTRIAN PB
24		16	02-6 1 RED	68	I5-2	6 PEDESTRIAN PB
25		17	02-7 1 YELLOW	69	I5-3	4 PEDESTRIAN PB
26		18	02-8 1 GREEN	70	I5-4	8 PEDESTRIAN PB
27		19	03-1 8P DONT WALK	71	I5-5	EVA PREEMPT
28		20	03-2 8P WALK	72	I5-6	EVB PREEMPT
29		21	03-3 8 RED	73	I5-7	EVC PREEMPT
30		22	03-4 8 YELLOW	74	I5-8	EVD PREEMPT
31		23	03-5 8 GREEN	75	I6-1	SPARE 3
32		24	03-6 OVERLAP B RED	76	I6-2	2 CALL
33		25	03-7 OVERLAP B YELLOW	77	I6-3	6 CALL
34		26	03-8 OVERLAP B GREEN	78	I6-4	4 CALL
35		27	04-1 6P DONT WALK	79	I6-5	8 CALL
36		28	04-2 6P WALK	80	I6-6	ADVANCE
37		29	04-3 6 RED	81	I6-7	FLASH SENSE
38		30	04-4 6 YELLOW	82	I6-8	STOP TIME
39		31	04-5 6 GREEN	83	06-1	reserved
40		32	04-6 5 RED	84	06-2	reserved
41		33	04-7 5 YELLOW	85	06-3	OVERLAP D RED
42		34	04-8 5 GREEN	86	06-4	OVERLAP D YEL
43		35	05-1 PREEMPT BEACON EVA	87	06-5	OVERLAP D GRN
44		36	05-2 PREEMPT BEACON EVC	88	06-6	OVERLAP D RED
45		37	05-3 PREEMPT BEACON EVB	89	06-7	OVERLAP C YEL
46		38	05-4 PREEMPT BEACON EVD	90	06-8	OVERLAP C GRN
47		39	II-I 2 EXTENSION & COUNT	91	07-1	TOD OUTPUT1
48		40	I1-2 6 EXTENSION & COUNT	92	* *	logic ground
49		41	I1-3 4 EXTENSION & COUNT	93	07-2	TOD OUTPUT2
50		42	I1-4 8 EXTENSION & COUNT	94	07-3	OVERLAP B RED
51		43	I1-5 2 EXTENSION & COUNT	95	07-4	OVERLAP B YEL
52		44	I1-6 6 EXTENSION & COUNT	96	07-5	OVERLAP B GRN

1	45	I1-7	4 EXTENSION & COUNT	97	07-6	OVERLAP A RED
2	46	I1-8	8 EXTENSION & COUNT	98	07-7	OVERLAP A YEL
3	47	I2-1	2 CALL DETECTOR	99	07-8	OVERLAP A GRN
4	48	I2-2	6 CALL DETECTOR	100	05-5	reserved
5	49	I2-3	4 CALL DETECTOR	101	05-6	FLASH OUTPUT
6	50	I2-4	8 CALL DETECTOR	102	05-7	reserved
7	51	I2-5	RRI (CLR-FLASH)	103	05-8	WATCHDOG
8	52	I2-6	RR2 (CLR-LIMITED SERV)	104	**	logic ground

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10 GMNCAUX.DT1

11

(NWR September 16, 2002)

12

Auxiliary Equipment for NEMA Controllers

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Section 9-29.13(7)B is supplemented with the following:

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NEMA Traffic Actuated Controllers

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The cabinet(s) shall contain the following accessories and auxiliary equipment:

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Modem: When a NEMA master controller is installed, it shall have an external modem with a minimum baud rate of 14.4 Kbit per second. The modem shall have auto answer and auto hang-up operation.

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Convenience Outlet & Lamp Socket: Two convenience outlets and a lamp socket shall be furnished in the cabinet(s). The outlets shall be mounted one on each side of the cabinet, near the top shelf, not on the door. The outlet mounted on the right side shall be ground fault interrupted protected. A switch shall activate the lamp when the door is open. These circuits shall be protected by a circuit breaker rated at 25 Amps. An incandescent 150-watt bulb shall be provided. The light shall be installed a minimum of 12 inches from the vent fan thermostat.

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Power Supply: A +24 volt DC regulated power supply capable of supplying 4.8 amperes continuously shall be provided. The power supply shall be shelf mounted and have a connector part number MS3102A-18-1P with the following pinout:

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Pin 1	AC+	Pin 3	DC-
Pin 2	AC-	Pin 4	+24V DC

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40

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The supply shall be separate from the controller power supply and connected to the second channel of the conflict monitor.

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Schematics & Manuals: The cabinet(s) shall have a waterproof envelope with a side access attached to the inside of the door. At the time of delivery the envelope shall have two complete sets of schematics and manuals for all assemblies and sub-assemblies. In addition, the cabinet shall arrive with two sets of cabinet prints including circuit schematics for each model of the following:

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47

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49

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51

1. Controller
2. Conflict Monitor

52

3. Preemption Equipment
4. Loop Amplifiers
5. Detection

Fourth (D) Connector: A CPC black plastic fourth connector (part no. AMP 205842-1) shall be provided with the following pin assignments:

1	Emergency Preempt 4 Out	2	
3		4	Special Function 2 Out
5		6	
7		8	
9		10	
11	Flash Out	12	
13	Auxiliary Detection #8	14	
15	Special Function 3 Out	16	
17	Auxiliary Detection #1	18	Auxiliary Detection #4
19	System Enable	20	
21		22	Emergency Preempt 2 Out
23	Emergency Preempt Railroad	24	
25	on Special Function 2 In	26	Special Function 1 In
27	Free/Coordinate Out	28	Special Function 1 Out
29		30	Auxiliary Detection #5
31	Auxiliary Detection #3	32	Emergency Preempt 1 Out
33		34	Emergency Preempt 3 Out
35	Special Function 3 In	36	
37	Flash Status In	38	
39	Auxiliary Detection #6	40	Auxiliary Detection #7
41		42	
43		44	
45		46	
47	Auxiliary Detection #2	48	
49	EVP-1 (In)	50	EVP-2 (In)
51		52	
53		54	
55	EVP-3 (In)	56	EVP-4 (In)
57	Railroad Preempt (In)	58	
59		60	Flash Command In

Service Panel Switches

Power Switches: There shall **not** be a main power switch inside the cabinet(s) that shall render all control equipment electrically dead when turned off. There shall be a controller power switch that shall render the controller and load switching devices electrically dead while maintaining flashing operation for purposes of changing the controller or load switching devices. The switch shall be a general purpose bat style toggle switch with an approximately 11/16 in. long bat. The switch shall have a protective cover, which must be lifted to operate the switch.

Stop Time Switch: There shall be a 3 position switch located inside the cabinet door identified as the Stop Time switch. Its

positions shall be labeled "Normal" (up), "Off" (center), and "On" (down). With the switch in its Normal position, a stop timing command may be applied to the controller by the police flash switch or the conflict monitor unit. When the switch is in its "Off" position, stop timing commands shall be removed from the controller. The "On" position of the switch shall cause the controller to stop timing. The switch shall be a general purpose bat style toggle switch with an approximately 11/16 in. long bat. The switch shall have a protective cover, which must be lifted to operate the switch.

Detector Disconnect/Test Switches: All eight controller phase inputs shall have disconnect/test switches. Pedestrian detection shall have disconnect/test switches by phase. These switches shall be located inside the cabinet door and labeled by associated phase number. The 3 positions of the switches shall be labeled "Normal" (up) which shall connect the controller to its detector output; "Off" (Center) which shall isolate the controller detection input; and "Test" (down) which shall provide a momentary logic ground to the controller detection input. A see-through Plexiglas cover shall cover all detector disconnect/test switches.

Police Panel Switches

Red Flash Program: Flash operation must be programmable without removing field wiring (i.e. red/yellow jumpers). The cabinet shall be delivered programmed for all red flash.

Load Switches: Load switching devices shall conform to the physical and electrical characteristics specified in NEMA Publication No. TS1-1976, Part 5 (TS1-5.01 - Triple-Signal Load Switching). They shall use modular solid state relays and have status indicators for each input and output. They shall be interchangeable. The load switches shall be rack-mounted and supported to relieve tension on the connections. Load switches shall be provided for all phases, not just phases used with the current configuration. The cabinet shall be furnished with a 16 position load bay. Load switches shall include indicator lights on both the input and output circuits.

Conflict Monitor Unit: The conflict monitor shall be a unit capable of monitoring proper signal operation of 12 channels. It shall conform to the physical and electrical characteristics specified in the latest NEMA Publication and the following. The monitor shall have a LCD-type display with separate indications for red, yellow, green and walk intervals for each channel. The monitor shall clearly display the status of each input during normal operation and failure condition. No flashing indications will be accepted. The monitor shall log the type of failure, the channels involved, the time and the date for a minimum of 8 events. The monitor shall have a printer port available. All cables and software to communicate with the monitor shall be provided. Clearing the log shall be possible from the front panel.

Pedestrian Detector Field Wiring: All pedestrian detectors shall be connected between logic ground and their appropriate field terminal. The terminals shall be grouped together and located in the lower left side panel.

Cabinet Relays: All mechanical relays shall be commonly available from more than one manufacturer and have 24 Volt DC or 120 Volt AC relay coils. Every socket, which has the capacity of accepting a relay or load switch, shall have the appropriate relay or load switch installed. The relays shall be easily accessible, not covered by equipment or wiring.

Preemption Equipment: Each call channel of the discriminators shall be wired through a disconnect/test switch, located on the service panel, which operates in the same manner as the Detector Disconnect/Test switches. The discriminators shall be located in the detector rack.

No calls shall be placed on the non-preempt phases. Preempt calls shall be inhibited during Flashing operation.

Signal Loop Amplifiers: A total of 16 two channel loop amplifiers are required at each cabinet. Amplifiers shall be 3M Canoga Model C822T, IDC-Detector Systems 292T, or Reno A&E Type "C1203" for NEMA cabinets.

Field Wiring Terminals: There shall be terminal strips for field wiring in the controller cabinet. The terminals shall be numbered in accordance to the field wiring chart included in these specifications. A common bus bar with a minimum of 15 spare terminals shall be available after the cabinet is fully wired. In addition, a 15 terminal bar shall be provided for the pedestrian common and a terminal shall be provided for each signal head neutral. The bus bars shall be located on the left side wall of the cabinet.

Interference Suppressers: All power supplies of equipment used here shall have electrical interference immunity from other devices within the cabinet.

Surge Protector (Lightning Arrester): The cabinet(s) shall have an input voltage surge protector that shall protect the controller power supply input from any voltage surges that could damage it. Interconnect cable terminal strips shall be equipped with lightning surge protectors. The cabinet shall be wired to light LED indicators when surge protection has been activated. The LED indicator shall be mounted facing the front to allow unobstructed view of the indicator. In addition, there shall be a metal oxide varactor (MOV) between ground and hot and between the neutral and ground.

Power Panel Cover: The power panel shall be covered by an easily removable, clear Plexiglas cover.

AC Delay Relay: A delay relay shall be provided which shall delay AC power to the controller and conflict monitor, programmable for 1 to 5 seconds delay, upon restoration of power to the cabinet.

Detector Rack Configuration:

Detector racks shall have a socket with a 44 pin wiring configuration. Detector racks shall be configured as follows:

DETECTOR RACK

Phase 1	Phase 1	Phase 5	Phase 5	PreEmpt Chan 1
816-817	818-819	856-857	858-859	
Phase 6	Phase 6	Phase 2	Phase 2	
866-867	963-964	826-827	923-924	

DETECTOR RACK

Phase 6	Phase 6	Phase 2	Phase 2	PreEmpt Chan 2
868-869	961-962	828-829	921-922	
Phase 6	Phase 6	Phase 2	Phase 2	
967-968	965-966	927-928	925-926	

DETECTOR RACK

Phase 3	Phase 3	Phase 7	Phase 7	PreEmpt Chan 3
836-837	838-839	876-877	878-879	
Phase 8	Phase 8	Phase 4	Phase 4	
886-887	983-984	846-847	943-944	

DETECTOR RACK

Phase 8	Phase 8	Phase 4	Phase 4	PreEmpt Chan 4
888-889	981-982	848-849	941-942	
Phase 8	Phase 8	Phase 4	Phase 4	
987-988	985-986	947-948	945-946	

All 800 series numbers are connected to the appropriate NEMA phase controller inputs through a service panel detector switch. All 900 series numbers are connected to the appropriate NEMA plus controller auxiliary detector inputs through a service panel detector switch.

GMCAUX.DT1

(NWR March 8, 2004)

Auxiliary Equipment for Type 170E, 2070, 2070 Lite, ITS/ATC Controllers

Section 9-29.13(7)C is supplemented with the following:

Traffic signal control equipment to be furnished shall be provided with:

1. Flash Indication Jumper Plugs

- 1 One for each vehicle display load switch socket (eight minimum).
2 Provides quick and easy change of indications, either red or
3 yellow, for display during flashing operations.
4
- 5 2. Load Switches
6 All load switches shall be model 200 units equipped with
7 replaceable solid state relay modules. Load switches shall be
8 provided for all phases, not just phases used with the current
9 configuration.
10
- 11 3. Detection Panel
12 The detection panel configuration shall conform to the details
13 shown in the Plans. Detection test switches shall be provided for
14 each vehicle and pedestrian input on the input file. The
15 indicators shall be high intensity LEDs.
16
- 17 4. Conflict Monitor
18 For type 170E controllers, the conflict monitor shall be a Model
19 210N unit. For 2070, 2070 Lite and ITS/ATC controllers the
20 conflict monitor shall be a Model 2010 ECL unit.
21
- 22 5. Signal Loop Amplifiers
23 A total of 16 two-channel loop amplifiers are required at each
24 cabinet. Amplifiers shall be 3M Canoga Model C822T, IDC-
25 Detector Systems 292T, Reno A & E Type "C1103-SS", or Eberle
26 Designs "Oracle2."
27
- 28 FMCAUX4.DT1
29 (NWR April 13, 1996)
30 \$\$1\$\$\$. Display Panel
31 The display panel shall depict a generic eight-phase operation.
32 Panel configuration shall conform to the details shown in the
33 Plans. Panel mounting shall be of a type that allows installation
34 of the panel in four different orientations. The connecting cable
35 shall be long enough to allow any mounting orientation. No
36 diodes will be allowed.
37
- 38 GM24000.DT1
39 (NWR April 3, 1995)
40 When a Type 170 master controller is installed, it shall have a Model
41 24000 modem.
42
- 43 FM2400SA.DT1
44 (NWR April 3, 1995)
45 A Model 2400SA modem shall be installed at ***\$\$1\$\$***.
46
- 47 FMSM2400.DT1
48 (NWR April 3, 1995)
49 A Model SM2400 modem shall be installed at ***\$\$1\$\$***.
50
- 51 FM400.DT1
52 (NWR April 3, 1995)

1 A Model 400 modem with a C2 connector cable shall be installed at the
2 following location(s):
3
4 ***\$\$1\$\$***
5
6 GMCAB.DT1
7 (NWR September 16, 2002)
8 **NEMA Controller Cabinets**
9 Section 9-29.13(7)D is supplemented with the following:
10
11 Construction shall be of 0.125-inch sheet aluminum (5052 alloy), with mill
12 finish. The cabinet shall not be anodized and the exterior shall not be
13 painted.
14
15 GMNCAB.DT1
16 (NWR April 28, 1999)
17 The cabinet shall be wired for eight vehicle phases, four pedestrian
18 phases, four overlaps, and use with a modem.
19
20 The cabinet shall have a computer shelf 16 inches wide and 12 inches
21 deep centered under the lower shelf.
22
23 Where the Plans call for a master controller the cabinet shall be wired for
24 use with the master controller.
25
26 GMADAPT.DT1
27 (NWR April 28, 1999)
28 The adaptor box shall be fabricated from .125-inch aluminum (5052 alloy),
29 with mill finish. The cabinet shall not be anodized and the exterior shall
30 not be painted.
31
32 The Contractor shall verify foundation and cabinet dimensions and
33 mounting bolt patterns prior to submitting shop drawings for the adaptor
34 box to the Engineer. The shop drawings shall be submitted for approval
35 10 working days in advance of fabrication.
36
37 The new controller cabinet, if Contracting Agency-supplied, will be
38 available for bolt pattern verification as identified under the subsection,
39 ***Contracting Agency-Supplied Materials*** of this provision.
40
41 GM170CAB.DT1
42 (NWR September 16, 2002)
43 **Type 170E, 170E-HC-11, 2070, 2070 Lite, ATC Controller Cabinets**
44 Section 9-29.13(7)E is supplemented with the following:
45
46 Construction shall be of 0.125-inch sheet aluminum (5052 alloy), with mill
47 finish. The cabinet shall not be anodized and the exterior shall not be
48 painted.
49
50 Field wire terminals shall be labeled in accordance with the Field Wiring
51 Chart.
52

1 GM170ADAPT.DT1
2 (NWR September 16, 2002)
3 The adaptor box shall be fabricated from .125-inch aluminum (5052 alloy),
4 with mill finish. The cabinet shall not be anodized and the exterior shall
5 not be painted.
6
7 The Contractor shall verify foundation and cabinet dimensions and
8 mounting bolt patterns prior to submitting shop drawings for the adaptor
9 box to the Engineer. The shop drawings shall be submitted for approval
10 10 working days in advance of fabrication.
11
12 The new controller cabinet, if Contracting Agency-supplied, will be
13 available for bolt pattern verification as identified under the subsection,
14 **Contracting Agency-Supplied Materials** of this provision.
15

16 GMFLASH.DT1
17 **(NWR April 1, 2002)**
18 **Flashing Beacon Control**
19 Section 9-29.15 is supplemented with the following:
20

21 **Solid State Flasher**

22 The solid state flasher shall provide two output circuits to permit alternate flashing
23 of signal faces. The flash rate shall be 55 flashes per minute $\pm 10\%$. Duty cycle for
24 each circuit shall be 50% on, 50% off $\pm 2\%$.
25

26 Each circuit shall be rated at 15 amperes and switching shall occur at the zero
27 crossover point of the AC voltage. The voltage range shall be 95 to 135 volts AC.
28 The nominal voltage shall be 120 volts AC. The operating frequency range shall be
29 60 Hz ± 3.0 Hz. The two-circuit solid-state flasher shall be designed to operate as
30 specified at any ambient temperature range from -30°F. to +165°F. (-34.4°C. to
31 +73.8°C).
32

33 **Cabinet**

34 The raintight housing shall be aluminum, conforming to the requirements of
35 Section 9-29.25 and this Special Provision. Cabinet dimensions shall be:
36

37	<u>Depth</u>	<u>Height</u>	<u>Width</u>
38			
39	6 inches	10 inches	8 inches

40
41 The cabinet door shall be hinged and secured with a spring-loaded construction
42 core lock capable of accepting a Best CX series core to be installed by others.
43 Socket bases for the flasher unit shall be mounted on a circuit board inside the
44 cabinet.
45

46 GMHEAD.DT1
47 **(NWR March 8, 2004)**
48 **Vehicular Signal Heads**
49 Section 9-29.16 is supplemented with the following:
50

1 **Covering Material**
2 Signal head covering material shall consist of 4 mil minimum thickness black
3 polyethylene sheeting.

4
5 **Backplates**
6 Backplates shall be constructed of vented flat black anodized aluminum and shall
7 be mounted with stainless steel hardware.

8
9 GMFIBER.DT1
10 **(NWR March 8, 2000)**
11 **Fiber Optic Signal Head**
12 A 12-inch fiber optic signal section capable of alternately displaying a yellow arrow
13 and a green arrow shall be furnished and installed where specified in the Plans.

14
15 GMOPT.DT1
16 **(NWR March 8, 2004)**
17 **Optical Units**
18 Section 9-29.16(2)A is supplemented with the following:

19
20 All traffic signal displays shall be the Light Emitting Diode (LED) type and shall
21 be from one of the following manufacturers:

22
23 Dialight Corporation
24 1913 Atlantic Avenue
25 Manasquan, NJ 08736
26 Telephone: (732) 223-9400
27 Fax: (732) 223-8788

28
29 GELcore, LLC
30 6810 Halle Drive
31 Valley View, OH 44125
32 Telephone: (216) 606-6555
33 Fax: (216) 606-6556

34
35 Precision Solar Controls, Inc.
36 2960 Market Street
37 Garland, TX 75041
38 Telephone: (972) 278-0553
39 Fax: (972) 271-9583

40
41 Each LED signal module shall be designed to be installed in the door frame of
42 a standard traffic signal housing. The lamp socket, reflector holder and lens
43 used with an incandescent lamp shall not be used in a signal section in which
44 a LED signal module is installed. The installation of an LED signal module
45 shall not require any modification to the housing. The LED signal module shall
46 be a single, self-contained device, not requiring onsite assembly for installation
47 into an existing traffic signal housing.

48
49 All red and yellow LED signal modules shall be manufactured with a matrix of
50 AlInGaP LED light sources and green LED signal modules shall be
51 manufactures with a matrix of InGaN LED light sources. The LED traffic signal
52 module shall be operationally compatible with controllers and conflict monitors

1 on this project. The LED lamp unit shall contain a disconnect that will show an
2 open switch to the conflict monitor when less than 60% of the LEDs in the unit
3 are operational.
4
5 Each LED module shall conform to the current standards in Institute of
6 Transportation Engineers (ITE) VTC SH Part 2 and a Certificate of Compliance
7 with these standards shall be submitted by the manufacturer for each type of
8 signal head. The certificate shall state that the lot of signal heads meets the
9 current ITE specification. A label shall be placed on each LED signal module
10 certifying conformance to this specification. The manufacturer's name,
11 trademark, serial number and other necessary identification shall be
12 permanently marked on the backside of the LED signal module. LED signal
13 modules used on this project shall be from the same manufacturer. A label
14 shall be provided on the LED housing and the Contractor shall mark the label
15 with a permanent marker to note the installation date.
16
17 The manufacturer shall provide a written warranty against defects in materials
18 and workmanship for the LED signal modules for a period of 60 months after
19 the installation of the modules. All warranty documentation shall be given to
20 the Engineer prior to installation.

21
22 GMSHMB.DT1
23 ***Signal Head Mounting Brackets and Fittings***
24 Section 9-29.17 is supplemented with the following:

25
26 (NWR March 13, 1995)
27 The Type M mounting bracket shall be a bronze plumbizer.
28

29 GMVDET.DT1
30 ***Vehicle Detector***
31 Section 9-29.18 is supplemented with the following:
32

33 GMLOOP.DT1
34 (NWR April 3, 1996)
35 Amplifiers shall be capable of generating a continuous output to the controller when
36 a loop or lead-in failure occurs.
37

38 GMSEAL.DT1
39 (NWR March 8, 2004)
40 Loop sealant for use in ACP pavement shall be one of the following:
41

- 42 1. RAI Pro-Seal 6006EX
43 2. QCM EAS-14
44 3. 3M Black 5000
45

46 Loop sealant for use on concrete bridge decks and PCC pavement shall be one of
47 the following:
48

- 49 1. 3M Black 5000
50 2. Gold Label Flex 1P
51 3. QCM EAS-14
52

1 Installation shall conform to the manufacturer's recommendations.

2

3 GMPPB.DT1

4 **(NWR September 16, 2002)**

5 **Pedestrian Push Buttons**

6 Section 9-29.19 is supplemented with the following:

7

8 The assembly shall be constructed so that it will be impossible to receive an
9 electrical shock under any weather conditions.

10

11 GMPED.DT1

12 **Pedestrian Signals**

13 Section 9-29.20 is supplemented with the following:

14

15 GMAUD.DT1

16 **(NWR April 16, 2001)**

17 **Audible Pedestrian Indicators**

18 Audible pedestrian indicators shall meet the requirements of the American Disability
19 Act. Installation shall be done in conformance with procedures specified by the
20 manufacturer and approved by the Engineer.

21

22 Output shall be adjustable to provide a "Cuckoo" indication for north south
23 movements or a "Peep-Peep" indication for east west movements. The indicators
24 shall be self switching to one of two adjustable output levels depending on ambient
25 noise conditions.

26

27 Indicators shall be olive green.

28

29 Indicators shall mount on top of pedestrian signals with a flex mount which can be
30 used to aim the indicator. The mounting hardware shall incorporate an O ring and
31 shall prevent entrance of moisture into the pedestrian signal.

32

33 Indicators shall function when wired to the walk terminal and to the AC neutral
34 terminal of the associated pedestrian signal.

35

36 GMPEDLED.DT1

37 **(NWR April 16, 2001)**

38 **LED Pedestrian Signal Modules**

39 All pedestrian signal displays shall be the Light Emitting Diode (LED) type. Each
40 LED pedestrian signal module shall be designed as retrofit replacements for optical
41 units in a standard pedestrian signal housing and shall not require special tools for
42 installation. The installation of an LED pedestrian module shall not require any
43 modification to the housing. Each LED pedestrian module shall be a single, self-
44 contained device, not requiring any on-site assembly for installation into any
45 pedestrian signal housing. The power supply for the LED pedestrian module may
46 be packaged as a separate module.

47

48 All pedestrian "HAND" modules shall be Portland Orange and shall conform to
49 current ITE standards for size, chromaticity and intensity. LED pedestrian "HAND"
50 modules shall be manufactured with a matrix of AlInGaP LED light sources. All
51 pedestrian walking "MAN" modules shall be Lunar White and shall conform to
52 current ITE standards for size, chromaticity and intensity. LED pedestrian walking

1 "MAN" modules shall be manufactured with a matrix of InGaN LED light sources.
2 The "HAND" and walking "MAN" message bearing surfaces shall be filled, not
3 outline, symbols. The LED pedestrian modules shall be operationally compatible
4 with controllers and conflict monitors on this project.

5
6 The LED pedestrian module shall be rated for use in the ambient operating
7 temperature range of -40°F to 165°F. Each LED pedestrian module shall be
8 protected against dust and moisture intrusion per the NEMA Moisture Resistant
9 STD 250-1991 for Type 4 enclosures to protect all internal components. The
10 assembly, manufacturing, and mounting of the LED pedestrian module shall be
11 designed to assure all internal LED and electronic components are adequately
12 supported to withstand mechanical shock and vibration from high winds and other
13 sources. The manufacturer's name, trademark, serial number and other necessary
14 identification shall be permanently marked on the backside of the LED pedestrian
15 module. LED signal pedestrian modules used on this project shall be from the
16 same manufacturer. A label shall be provided on the LED housing and the
17 Contractor shall mark the label with a permanent marker to note the installation
18 date.

19
20 LED pedestrian modules shall operate at a maximum power consumption of 15W.
21 Each LED pedestrian module shall operate from a 60±3 Hz AC line over a range of
22 80VAC to 135VAC. Nominal operating voltage for all measurements shall be
23 120±3 volts rms. The LED circuitry shall prevent flicker at less than 100 Hz over
24 the voltage range specified above. Fluctuations in the line voltage specified above
25 shall not affect luminous intensity by more than ±10%. The signal module on-board
26 circuitry shall include voltage surge protection to withstand high-repetition noise
27 transients and low-repetition high-energy transients as stated in Section 2.1.6,
28 NEMA Standard TS-2, 1992. The individual LED light sources shall be wired so
29 that catastrophic failure of any one LED light source will result in the loss of not
30 more than 20% of the signal module light sources. LED pedestrian signal modules
31 shall provide a power factor of 0.90 or greater when operated at nominal operating
32 voltage, and 77°C. Total harmonic distortion induced into an AC power line by an
33 LED pedestrian module shall not exceed 20%. Each LED pedestrian module and
34 associated onboard circuitry shall meet Federal Communications Commission
35 (FCC) Title 47, SubPartB, Section 15 regulations concerning the emission of
36 electrical noise. Two secured, color coded, 600V, 20AWG minimum, jacketed
37 wires, conforming to the National Electrical Code, rated for service at 221°C, are to
38 be provided for electrical connection.

39
40 The manufacturer shall provide a written warranty against defects in materials and
41 workmanship for the LED signal modules for a period of 60 months and against
42 loss of intensity below 50% of original values for a period of 36 months after
43 installation of the modules. All warranty documentation shall be given to the
44 Engineer prior to installation.

45
46 GMSERV.DT1

47 **(NWR September 16, 2002)**
48 **Service Cabinets**

49 Section 9-29.24 is supplemented with the following:
50

1 Service cabinets shall be fabricated from 0.125 inch sheet aluminum (5052 alloy)
2 with mill finish. The aluminum shall not be anodized and the exterior shall not be
3 painted.
4
5 Service cabinets shall have ventilation louvers on the lower sides complete with
6 screens and filters.
7
8 A spring-loaded construction core lock capable of accepting a Best CX series core
9 installed by others shall be installed on all doors accessing WSDOT equipment.
10
11 The main cabinet door shall include a two-position door stop assembly and shall
12 have a three point latch.
13
14 A three-position terminal block shall be installed between the main electrical service
15 panel and the photo cell assembly base.
16
17 The cabinet bonding connection shall be a welded plate with stainless steel
18 hardware, Belleville washers, cu/al lug, and antioxidant compound. The bolt shall
19 be torqued to fully compress the Belleville washers.
20
21 Steel conduit penetrating the cabinet shall have a grounding bushing and shall be
22 bonded to the system ground.
23
24 GMATT.DT1
25 ***Amplifier, Transformer, and Terminal Cabinets***
26 Section 9-29.25 is supplemented with the following:
27
28 (NWR August 5, 1996)
29 Cabinets shall be fabricated from 0.125-inch sheet aluminum (5052 alloy) with mill
30 finish. Cabinets shall not be anodized and the exterior shall not be painted.
31
32 GMCONST.DT1
33 **Construction Requirements**
34 Section 8-20.3 is supplemented with the following:
35
36 GCG.DT1
37 ***General***
38 Section 8-20.3(1) is supplemented with the following:
39
40 FCORDER.DT1
41 ***(*****)***
42 **Electrical Order of Work**
43 \$\$1\$\$
44
45 GCENER.DT1
46 (NWR May 15, 2000)
47 Work shall be coordinated so that electrical equipment, with the exception of the
48 service cabinet, is energized within 72 hours of installation.
49
50 GCTEMP.DT1
51 (NWR June 20, 1995)

1 Poles designated for removal shall not be removed prior to approval of the
2 Engineer.
3
4 GCCREM.DT1
5 **(NWR May 15, 2000)**
6 **Removals**
7 Removals associated with the electrical system shall not be stockpiled within the
8 job site without the Engineer's approval.
9
10 FCCREM.DT1
11 (NWR April 18, 1996)
12 A portion of the existing electrical equipment to be removed shall remain the
13 property of the Contracting Agency.
14
15 The following shall be disconnected, dismantled, and delivered to the Contracting
16 Agency as specified in the subsection **Delivery of Removed Items**:
17
18 ***\$\$1\$\$***
19
20 GCCREM2.DT1
21 (NWR April 11, 2001)
22 Remove all wires from salvaged light and signal standards.
23
24 GCCONTR.DT1
25 (NWR September 20, 1995)
26 Controller cabinets shall not be removed until all associated electronic equipment is
27 removed by Contracting Agency signals personnel. All other equipment shall be
28 removed by the Contractor and delivered within 24 hours following removal to the
29 Contracting Agency.
30
31 GCSPAN.DT1
32 (NWR November 16, 1995)
33 Span wire shall not be lowered or disconnected from strain poles until all
34 associated signal heads and signs have been removed from the span.
35
36 GCSREM.DT1
37 **(NWR August 5, 1996)**
38 **Pole Shaft and Mast Arm Identification**
39 All removed mast arms and pole shafts shall be identified by paper
40 identification tags recording pole number, intersection location (such as SR
41 XXX, Jct XXX), and mast arm length.
42
43 Four inch by six inch (minimum) tags shall be taped to corresponding pole
44 shafts and mast arms. Information on the mast arm tag shall match the
45 information on the corresponding pole shaft tag. Each tag shall be entirely
46 covered with clear acetate tape. The tape shall be wrapped one full circle
47 around the shaft or arm with a 1/2 inch minimum overlap at the ends and
48 sides.
49
50 The Contractor shall bundle the complete signal standard assembly together. The
51 assembly consists of pole shaft, mast arm, and connecting bolts. Connecting bolts
52 shall be attached to the original mast arm base plate.

1
2 GCCPROP.DT1

3 (NWR April 11, 2001)

4 All removals associated with an electrical system, which are not designated to
5 remain the property of the Contracting Agency, shall become the property of the
6 Contractor and shall be removed from the project.
7

8 The Contractor shall:

9
10 Remove all wires for discontinued circuits from the conduit system.

11
12 Remove elbow sections of abandoned conduit entering junction boxes.

13
14 Abandoned conduit encountered during excavation shall be removed to the
15 nearest outlets or as directed by the Engineer.
16

17 Remove foundations entirely, unless the Plans state otherwise.

18
19 Backfill voids created by removal of foundations and junction boxes.
20 Backfilling and compaction shall be performed in accordance with Section 2-
21 09.3(1)E.
22

23 FCTREM.DT1

24 (*****)

25 **Relocation and Removal of Temporary Illumination**

26 \$\$1\$\$
27

28 GCELEQ.DT1

29 (NWR April 11, 2001)

30 **Delivery of Removed Items**

31 Removed electrical equipment which remains the property of the Contracting
32 Agency shall be delivered to:
33

34 WSDOT Signal Shop
35 3700 9th Ave. So.
36 Seattle WA 98134
37 Phone: (206) 764-4014
38

39 Five days written advance notice shall be delivered to both the Engineer and the
40 Electronic Parts Specialist at the address listed above. Delivery shall occur during
41 the hours of 8:00 a.m. to 2:30 p.m. Monday thru Friday. Material will not be
42 accepted without the required advance notice.
43

44 Equipment damaged during removal or delivery shall be repaired or replaced to the
45 Engineer's satisfaction at no cost to the Contracting Agency.
46

47 The Contractor shall be responsible for unloading the equipment where directed by
48 the Engineer at the delivery site.
49

1 GCSURF.DT1

2 **(NWR May 15, 2000)**

3 **Surface Mounted Appurtenances**

4 Electrical appurtenances to be surface mounted on structures shall be mounted so
5 that a minimum ¼ inch space is maintained between the appurtenance and
6 structure.

7
8 GCCOND.DT1

9 **(NWR March 8, 2004)**

10 **Conduit**

11 Section 8-20.3(5) is supplemented with the following:

12
13 Conduit installed at the following locations shall be Rigid Galvanized Steel:

14
15 Within railroad right of way unless otherwise specified in the contract.

16
17 All runs within slip form structures.

18
19 Conduit risers except as otherwise required by serving utilities.

20
21 Surface mounted conduit other than conduit risers.

22
23 Couplings in cabinet foundations shall be Rigid Galvanized Steel. The stubouts
24 above the couplings shall be Rigid Galvanized Steel with grounding bushings.

25
26 Conduit installed using the directional boring method shall be UL listed High
27 Density Polyethylene (HDPE) Schedule 80, Carlon Bore-Gard Schedule 80 or Rigid
28 Galvanized Steel. Connections to HDPE conduit shall be made with an approved
29 mechanical coupler.

30
31 At all other locations, unless otherwise specified in the Plans, conduit shall be PVC
32 or Rigid Galvanized Steel.

33
34 Conduit shall be laid to a minimum depth of:

35
36 48 inches below the bottom of ties under rail road tracks.

37
38 24 inches below the curb grade in the sidewalk area.

39
40 24 inches below finished grade in all other areas.

41
42 Conduit stub-outs within cabinet foundations shall be placed so that they do not
43 interfere with cabinet installation. Modification of the cabinet to accommodate stub-
44 out placement is not allowed.

45
46 A pull string rated for 200 lbs. or greater shall be installed in all spare conduit.

47
48 All conduit including spare conduits shall be installed with bushings. Rigid
49 Galvanized Steel conduit shall be installed with insulated grounding bushings. PVC
50 conduit shall be installed with molded one-piece bell end bushings.

1 All conduits including spare conduits shall be installed with plugs, which shall not be
2 removed until installation of conductors or pull string. Upon installation of wiring,
3 conduit shall be sealed with duct seal. Upon installation of the pull string, spare
4 conduit shall be plugged

5
6 Conduit between light standards, PPB, PS or type I poles and the nearest junction
7 box shall be the diameter specified in the Plans. Larger size conduit is not allowed
8 at these locations.

9
10 Spacing of unistrut type channel supports for surface mounted conduit shall not
11 exceed 5 feet.

12
13 Where Rigid Galvanized Steel conduit is installed:

14
15 Insulated grounding end bushings shall have standard threading, which
16 extends around the entire circumference of the bushing.

17
18 Where PVC conduit is installed:

19
20 Conduit shall be schedule 40, with the exception that roadway crossings, and
21 service lateral runs shall be schedule 80. The same schedule and type of
22 conduit shall be used for the entire length of the run from outlet to outlet and
23 from HDPE conduit crossing the roadway to the nearest junction box.

24
25 Eighteen-inch radius elbows shall be used for conduit of 2-inch nominal
26 diameter or less.

27
28 Standard sweep elbows shall be used for conduit with greater than 2-inch
29 nominal diameter unless otherwise specified in the Plans.

30
31 With the exception of connections to HDPE conduit, joints shall be connected
32 with medium grade gray cement solvent applied per the manufacturer's
33 recommendations.

34
35 In conduit less than 2-inch nominal diameter, pull ropes for wire installation
36 shall be not less than ¼ inch diameter. In conduit of 2 inch nominal diameter
37 or larger, pull ropes for wire installation shall be not less than ½ inch diameter.

38
39 Trenches located within paved roadway areas shall be backfilled with 3 inches of
40 sand over the conduit, followed by controlled density fill meeting the requirements
41 of Section 2-09.3(1)E. Unless otherwise indicated in the Plans, the controlled
42 density fill shall be placed level to, and 3 inches below, the surface of the remaining
43 pavement, followed by 3 inches of paving material that matches the existing
44 material.

45
46 On new construction, conduit shall be placed prior to the placement of base course
47 pavement.

1 GCBORING.DT1

2 **(NWR August 22, 1996)**

3 **Boring**

4 Where boring with casing is called for casing shall be placed using an auger inside
5 of the casing to remove the soil as the casing is jacked forward. Boring operations
6 shall be conducted to prevent caving ahead of the pipe which will cause voids
7 outside the pipe. The auger head shall proceed no more than 4 inches ahead of
8 the pipe being jacked.

9
10 The Contractor shall submit to the Engineer for approval, a pit plan and a proposed
11 method of boring that includes, but is not limited to, the following:

12
13 a. A pit plan depicting:

- 14
15 1. Protection of traffic and pedestrians.
16 2. The dimension of the pit.
17 3. Shoring, bracing, struts, walers, or sheet pile
18 4. Type of casing

19
20 b. The proposed method of boring, including:

- 21
22 1. The boring system
23 2. The support system
24 3. The support system under and at the bottom of the pit.

25
26 The shoring and boring pit plan shall be prepared by and bear the seal and
27 signature of a Washington State licensed Professional Civil Engineer.

28
29 Installed casing pipe shall be free from grease, dirt, rust, moisture and any other
30 deleterious contaminants.

31
32 All joints shall be welded by a Washington State certified welder. Welding shall
33 conform to AWS D 1.1-80 Structural Welding Code, Section 3, Workmanship.

34
35 The space between the conduit and the casing shall be plugged with sand bags
36 and shall be filled with a grout sealant at least 1 foot thick at each end of the
37 casing. Casings abandoned due to encountered obstruction shall be grout sealed
38 in the same manner. Grout shall obtain a minimum of 400 psi compressive
39 strength at 7 days.

40
41 In lieu of sandbags and grout, unopened sacks of prepackaged concrete meeting
42 the requirements of Section 6-02.3(2)B may be used to seal the casing.

43
44 Material shall not be removed from the boring pits by washing or sluicing.

45
46 Bore pits shall be backfilled and compacted in accordance with Section 2-09.3(1)E.

47
48 GCDIRECT.DT1

49 **(NWR March 8, 2000)**

50 **Directional Boring**

51 Where directional boring is called for, conduit shall be installed using a surface
52 launched steerable drilling tool. Drilling shall be accomplished using a high

1 pressure fluid jet toolhead. The drilling fluid shall be used to maintain the stability of
2 the tunnel, reduce drag on the conduit and provide backfill between the conduit and
3 tunnel. A guidance system which measures the depth, lateral position and roll shall
4 be used to guide the toolhead when creating the pilot hole. Once the pilot hole is
5 established a reamer and swivel shall be used to install the conduit. Reaming
6 diameter shall not exceed 1.5 times the diameter of the conduit being installed.
7 Conduit which is being pulled into the tunnel shall be protected and supported so
8 that it moves freely and is not damaged during installation. The pullback force on
9 the conduit shall be controlled to prevent damage to the conduit. A vacuum spoils
10 extraction system shall be used to remove any excess spoils generated during the
11 installation. Excess drilling fluid and spoils shall be disposed of. The method and
12 location used for disposal of excess drilling fluid and spoils shall be subject to the
13 Engineers approval. Drilling fluid returns (caused by fracturing of formations) at
14 locations other than the entry and exit points shall be minimized. Any drilling fluid
15 that surfaces through fracturing shall be cleaned up immediately. Mobile spoils
16 removal equipment capable of quickly removing spoils from entry or exit pits and
17 areas with returns caused by fracturing shall be used as necessary during drilling
18 operations.

19
20 GCJB.DT1

21 **(NWR April 14, 2003)**

22 ***Junction Boxes, Cable Vaults, and Pull Boxes***

23 Section 8-20.3(6) is supplemented with the following:

24
25 Wiring shall not be pulled into any conduit until all associated junction boxes have
26 been adjusted to or installed in their final grade and location, unless installation is
27 necessary to maintain system operation. If wire is installed for this reason,
28 sufficient slack shall be left to allow for future adjustment.

29
30 Prior to construction of finished grade, if junction boxes are installed or adjusted,
31 pre-molded joint filler for expansion joints may be placed around the junction boxes.
32 The joint filler shall be removed prior to adjustment to finished grade.

33
34 Adjustments involving raising or lowering the junction boxes shall require conduit
35 modification if the resultant clearance between top of conduit and the junction box
36 lid becomes less than 6 inches or more than 8 inches in accordance with Standard
37 Plan J-11a. Wiring shall be replaced if sufficient slack as specified in Section
38 8-20.3(8) is not maintained.

39
40 The six-inch gravel pad required in Standard Plan J-11a shall be maintained. When
41 existing junction boxes do not have this gravel pad, it shall be installed as part of
42 the adjustment to finished grade.

43
44 Junction boxes installed on structures or embedded in structures including barrier
45 shall be stainless steel NEMA 4X.

46
47 Where conduit and junction boxes are placed in barrier, the prime Contractor shall
48 coordinate the work of the Contractor constructing the barrier and the electrical
49 Contractor so that each junction box placed in the barrier is placed in correct
50 alignment with respect to the barrier, with the face of the box flush or uniformly
51 chamfered within 1/2 inch of the barrier surface. If any point on the face of a
52 junction box placed in barrier is recessed more than 1/2 inch from the surface of the

- 1 barrier, the Contractor shall install a box extension per the Engineer's approval and
2 grout around the extension or remove and replace the entire section of barrier.
3
4 All junction boxes placed within the traveled way or shoulders shall be type 4, 5 or
5 6.
6
7 Type 4, 5 and 6 junction boxes shall be installed in accordance with the following:
8
9 1. Excavation and backfill shall be in accordance with Section 2-09.
10 Excavation for junction boxes shall be sufficient to leave 1 foot in the clear
11 between their outer surface and the earth bank.
12
13 2. The junction box shall be installed on a level 6-inch layer of crushed
14 surfacing top course, in accordance with 9-03.9(3), placed on a
15 compacted or undisturbed foundation. The crushed surfacing shall be
16 compacted in accordance with Section 2-09.3(1)E.
17
18 3. After installation, the lid shall be kept bolted down during periods when
19 work is not actively in progress at the junction box.
20
21 4. Before closing the lid, the lid and the frame shall be thoroughly brushed
22 and cleaned of all debris. There shall be absolutely no visible dirt, sand or
23 other foreign matter between the bearing surfaces.
24
25 5. When the lid is closed for the final time, a liberal coating of anti-seize
26 compound shall be applied to the bolts and nuts and the lid shall be
27 securely tightened.
28
29 6. Hinges shall be located on the side of the box, which is nearest to
30 adjacent shoulder. Hinges shall allow the lid to open 180 degrees.
31

32 200308.GR8

33 **Wiring**

34 Section 8-20.3(8) is supplemented with the following:
35

36 GCLABEL.DT1

37 (NWR April 14, 2003)

38 At each junction box, all illumination wires, power supply wires, and communication
39 cable shall be labeled with a PVC marking sleeve. For illumination and power
40 supply circuits the sleeve shall bear the circuit number. For communication cable
41 the sleeve shall be marked "Comm."
42

43 GCSPLICE.DT1

44 (NWR March 13, 1995)

45 All splices shall be made in the presence of the Engineer.
46

47 20CHART.GR8

48 **(March 13, 1995)**

49 **Field Wiring Chart**

50 501	AC+ Input	516-520 Railroad Pre-empt
51 502	AC- Input	5A1-5D5 Emergency Pre-empt

1	503-510	Control-Display	541-580 Coordination							
2	511-515	Sign Lights	581-599 Spare							
3										
4	Movement Number	1	2	3	4	5	6	7	8	9
5										
6	Vehicle Head									
7	Red	611	621	631	641	651	661	671	681	691
8	Yellow	612	622	632	642	652	662	672	682	692
9	Green	613	623	633	643	653	663	673	683	693
10	Spare	614	624	634	644	654	664	674	684	694
11	Spare	615	625	635	645	655	665	675	685	695
12	AC-	616	626	636	646	656	666	676	686	696
13	Red Auxiliary	617	627	637	647	657	667	677	687	697
14	Yellow Auxiliary	618	628	638	648	658	668	678	688	698
15	Green Auxiliary	619	629	639	649	659	669	679	689	699
16	Pedestrian Heads & Dets.									
17	Hand	711	721	731	741	751	761	771	781	791
18	Man	712	722	732	742	752	762	772	782	792
19	AC-	713	723	733	743	753	763	773	783	793
20	Detection	714	724	734	744	754	764	774	784	794
21	Common-Detection	715	725	735	745	755	765	775	785	795
22	Spare	716	726	736	746	756	766	776	786	796
23	Spare	717	727	737	747	757	767	777	787	797
24	Spare	718	728	738	748	758	768	778	788	798
25	Spare	719	729	739	749	759	769	779	789	799
26	Detection									
27	AC+	811	821	831	841	851	861	871	881	891
28	AC-	812	822	832	842	852	862	872	882	892
29	Common-Detection	813	823	833	843	853	863	873	883	893
30	Detection A	814	824	834	844	854	864	874	884	894
31	Detection B	815	825	835	845	855	865	875	885	895
32	Loop 1 Out	816	826	836	846	856	866	876	886	896
33	Loop 1 In	817	827	837	847	857	867	877	887	897
34	Loop 2 Out	818	828	838	848	858	868	878	888	898
35	Loop 2 In	819	829	839	849	859	869	879	889	899
36	Supplemental Detection									
37	Loop 3 Out	911	921	931	941	951	961	971	981	991
38	Loop 3 In	912	922	932	942	952	962	972	982	992
39	Loop 4 Out	913	923	933	943	953	963	973	983	993
40	Loop 4 In	914	924	934	944	954	964	974	984	994
41	Loop 5 Out	915	925	935	945	955	965	975	985	995
42	Loop 5 In	916	926	936	946	956	966	976	986	996
43	Loop 6 Out	917	927	937	947	957	967	977	987	997
44	Loop 6 In	918	928	938	948	958	968	978	988	998
45	Spare	919	929	939	949	959	969	979	989	999
46										
47	FCCINS.DT1									
48	(*****)									
49	Communication Cable Installation									
50	\$1\$1\$									
51										

(NWR August 5, 1996)

Communication Cable Acceptance Testing

Communications cable acceptance testing shall be performed for each pair of conductors. Acceptance testing shall commence only after all communication cable is installed, and all splices have been completed, with the exception of the splices connecting the new cable to existing cable. If any test fails, repairs shall be made by the Contractor and the entire test series shall be repeated.

Three tests shall be performed on each cable installation. All tests shall be conducted in the presence of the Engineer. The Contractor shall provide the necessary test equipment, perform the tests, and document the results. When the tests are completed, whether successful or not, the test result documentation shall be provided to the Engineer. All tests shall be conducted on all pairs in the communication cable to each cable drop point. Seven calendar days notice shall be given by the Contractor prior to performing any of the tests.

For each arterial all testing shall be conducted from the same cable drop point.

Continuity Test:

The continuity test shall be made on each conductor as well as the cable shield. Each conductor and/or shield shall show a resistance of not more than 20 ohms per 1,000 feet of conductor. The resistance of each conductor shall be recorded.

Insulation Test:

The insulation test shall be measured on each insulated conductor with all other conductors in the cable (including cable shield) grounded. The measurement shall be made with a DC potential of not less than 60% and not more than 90% of the insulation rating for 1 minute. Insulation resistance shall exceed 5,000 megohm-miles. The insulation resistance of each conductor shall be recorded.

Frequency Response and Noise Test:

The frequency response and noise tests shall be performed on each pair of conductors. All tests shall be made using transmission test instruments designed especially for use on data circuits. Two such instruments are required; one for use at the designated testing location and the other for use at each cable drop location.

The test sets shall be subject to approval by the Engineer prior to the start of the tests.

The first test shall measure frequency response from the test location to each cable drop. A tone of 0 dBm shall be applied to the transmitting end and the signal level shall be measured at the receiving end. The cable pair being tested shall be isolated from ground and terminated in 600 ohms at both test locations. A 10,000 ohm resistor shall terminate the same pair at all other cable drop locations. The test shall be performed at frequencies of 300, 500, 700, 1,004, 1,500, 2,300 and 3,000 Hz. The received tone shall be:

Greater than minus 16 dBm at 1,004 Hz.

2 dB gain to 8 dB loss with respect to the level at 1,004 Hz over the frequency range of 500 to 2,500 Hz.

2 dB gain to 12 dB loss with respect to the level at 1,004 Hz over the frequency ranges of 300 to 500 Hz and 2,500 to 3,000 Hz.

The second test shall measure circuit or background noise. The cable pair being tested shall be terminated the same as in the previous test. A C-message filter in the test set shall restrict the spectrum to the range normally used for voice-grade data circuits. The noise level shall be at least 13 dB below the lowest signal level measured in the first test.

All test data shall be recorded in an approved format. Cables which fail the tests shall be repaired or replaced as directed by the Engineer.

GCBOND.DT1

(NWR February 9, 2004)

Bonding, Grounding

Section 8-20.3(9) is supplemented with the following:

All appurtenances containing electrical conductors (junction boxes, luminaires, light standards, cabinets, metallic conduit, non-metallic conduit, etc.) shall be made mechanically and electrically secure to form a continuous system, which shall be effectively grounded.

Where existing conduits are utilized, an equipment-grounding conductor shall be installed.

In addition to the conductors called for in the contract, all conduit shall be installed with an equipment-grounding conductor sized per NEC 250-122 (No. 8 minimum).

Supplemental grounding shall be provided at light standards, signal standards, cantilever sign structures, and sign bridges. Steel sign posts which support signs with flashing beacons shall also have supplemental grounding. Foundations for these standards shall be installed with a bare number 6 copper wire that is connected to the reinforcing cage with an approved acorn clamp or cadweld and routed to connect to the pole at the grounding lug.

FCSEV.DT1

Service

Section 8-20.3(10) is supplemented with the following:

(*****)
\$\$1\$\$

GCFT.DT1

(NWR September 16, 2002)

Testing

Section 8-20.3(11) is supplemented with the following:

When the project includes a traffic signal, as part of the signal turn on procedure, the Contractor shall provide traffic control to stop all traffic from entering the intersection and shall then turn the traffic signal system to its flash mode to verify proper flash indications.

Prior to scheduling a turn-on date, the Contractor shall provide verification to the Engineer that:

- a. Field tests 1, 2, and 3 as specified in this section have been completed;
- b. All other field tests specified in Section 8-20.3(14)D have been completed.

Notification

The Contractor shall provide to the Engineer a minimum of five working days advance written notice of the proposed turn-on date and time.

Following turn-on, all conflicting signs shall be removed as directed by the Engineer.

GCNEWSIG.DT1

(NWR October 30, 1996)

New Signal

Prior to scheduling a turn-on date, the Contractor shall install on each approach leg a "New Signal Ahead" sign on a 4 x 6 wood post at a location staked by the Engineer.

GCREBSIG.DT1

(NWR October 30, 1996)

Rebuilt Signal

Prior to scheduling a turn-on date, the Contractor shall install on each approach leg a "Signal Revision Ahead" sign on a 4 x 6 wood post at a location staked by the Engineer.

During the changeover, traffic control shall be provided by Contractor-hired off-duty uniformed police officers having jurisdiction in the area.

The changeover from the existing to the new control equipment shall commence at 8:30 a.m. and be completed by 2:00 p.m. of the same day. The Engineer may allow variations on these hours depending on field observations.

GCILLUM.DT1

Illumination Systems

Light Standards

Section 8-20.3(13)A is supplemented with the following:

(NWR December 16, 2002)

All new light standards shall have the service number and light standard number painted 3 feet above the base using 3-inch series C numbers installed facing the traveled way. Paint shall be black enamel alkyd gloss conforming to Federal Specification TT E-489.

1 When slip bases are installed the conduit, anchor bolts, and other obstructions
2 shall terminate at a height below the elevation of the top of the bottom slip
3 plate. The galvanized surfaces of the slip plates, the keeper plate and the
4 luminaire base plate shall be smooth, without irregularities, to reduce friction
5 and to prevent slacking of bolt tension due to flattening of the irregularities.
6
7 FCCR.DT1
8 (*****)
9 \$\$1\$\$
10
11 FCFD.DT1
12 (*****)
13 **Foundation for Decorative Lighting Standard:**
14 \$\$1\$\$
15
16 GCSIGSYS.DT1
17 ***Signal Systems***
18
19 200314A.DT1
20 **Signal Controllers**
21 Section 8-20.3(14)A is supplemented with the following:
22
23 FCCTL.DT1
24 (March 13, 1995)
25 ***\$\$1\$\$\$*** will be delivered to the job site by the Contracting Agency.
26
27 FCADAPT.DT1
28 (NWR February 13, 1996)
29 The Contractor shall install an adaptor box for the controller cabinet retrofit at
30 ***\$\$1\$\$\$***. The adaptor box shall be secured to the existing foundation with
31 appropriately sized stainless steel cinch bolts.
32
33 GCTEST.DT1
34 **(NWR September 16, 2002)**
35 **Testing**
36 All signal control equipment shall be tested at the Washington State
37 Department of Transportation NW Region Signal Shop located at 3700 9th
38 Avenue South, Seattle, Washington 98134, prior to final delivery. The tests
39 shall check the operation of each individual component as well as the overall
40 operation of the system.
41
42 The Contractor shall designate a qualified representative for these tests.
43 Notification of this representative shall be submitted for approval, in writing, to
44 the NW Region Signal Shop, 14 calendar days prior to any equipment
45 deliveries. The Engineer shall also receive a copy of this notification, which
46 includes the representative's name, address, and telephone number. All
47 communications and actions regarding testing of all equipment submitted to
48 the NW Region Signal Shop shall be made through this representative. These
49 communications and actions shall include, but not be limited to, the following:
50
51 All notifications of failure or rejection, demonstration of the equipment, and
52 the return of rejected equipment.

The NW Region Signal Shop testing process will consist of the following four separate stages:

- a. Delivery and Assembly
- b. Demonstration and Documentation
- c. Performance Test
- d. Operational Test

Testing will follow in the correct order with no time gaps between stages unless mutually agreed upon by the Contractor and NW Region Signal Shop.

Stage 1 Delivery Assembly

All components for the complete traffic control systems, including the necessary test equipment, shall be assembled and ready for demonstration within ten working days of delivery to the NW Region Signal Shop. The systems shall simulate the operations as installed in the field.

Equipment and prerequisites necessary to complete this stage shall include:

- a. Detection Simulator:
The detection simulator shall provide at least one detector per phase and variable traffic volumes. One simulator shall be required for every two controllers tested.
- b. Communications Network:
Locations, specified for coordinating communications equipment and cable, shall be completely wired to provide an operational communications system between all local and master controllers.

The Contractor shall provide labor, equipment, and materials necessary to assemble all control equipment complete and ready for demonstration. Materials and equipment used for this stage that are not required for field installation shall remain the property of the Contractor. Failure to complete this stage within ten working days will result in rejection of the entire system.

Stage 2 Demonstration and Documentation

This stage shall be completed within seven working days following the completion of Stage 1. Failure to do so shall result in rejection of the entire shipment.

All documentation shall be furnished with the control equipment prior to the start of testing. If corrections to any document are deemed necessary by the State, the Contractor shall submit this updated version prior to the final approval by the NW Region Signal Shop. The documents to be supplied shall consist of or provide the following:

- a. A complete accounting of all the control and test equipment required.
- b. A complete set of documents which shall include:
 1. Serial numbers when applicable.

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2. Written certification that equipment of the same make and model has been tested according to NEMA Environmental Standards and Test Procedures, and has met or exceeded these standards. The certificate shall include equipment model number and where, when, and by whom the tests were conducted. This certificate shall accompany each shipment of controllers.
 3. Reproducible mylar wiring diagrams and two blue-tone prints for each controller and cabinet supplied. The sheet size shall be 24 inches by 36 inches.
 4. Wiring diagrams for all auxiliary equipment furnished. One set per cabinet.
 5. Complete operations and maintenance manuals including complete and correct software listing and flow charts. One set of operations and maintenance manuals per cabinet; at least four but no more than ten. Five sets of software listings and flow charts.
 6. Complete operations and maintenance manuals for all auxiliary equipment. One set per cabinet.
- c. A description of the functions and the capabilities of individual components and of the overall control system.
 - d. A presentation on how to operate the system.
 - e. A complete and thorough demonstration to show that all components of the control system are in good condition and operating properly, and proof that the controller and cabinet are functioning correctly.
 - f. Detailed instructions for installing and operating the controller(s), including explanations on the use of all features of the controller(s).
 - g. The operational and maintenance manuals for each traffic signal controller supplied including as a minimum, but not to be limited to the following:
 1. Detailed instructions for maintaining all hardware components, controller, and auxiliary equipment.
 2. A complete parts list detailing all manufacturer's identification codes.
 3. Detailed wiring diagrams and schematics indicating voltage levels and pictorial description, part name, and location for all hardware components, controller, and auxiliary equipment.

The demonstration shall include the following:

- a. Phasing per plans and all phase timing.
- b. Detection including any special detector functions.
- c. Conflict Monitor and Load Switches.
- d. Special Coordination including communication equipment.

This demonstration shall be performed by the Contractor in the presence of NW Region Signal Shop personnel. The Contractor shall supply any item not accounted for within five working days of the accounting. Controllers and cabinets that remain incomplete five working days after notification shall be rejected and returned freight collect to the Contractor.

Stage 3 Unit Performance Test

A minimum of ten working days shall be allowed for one or two cabinet assemblies and five working days for each additional assembly.

The unit performance test will be conducted by State Personnel to determine if each and every controller cabinet assembly complies with NEMA Environmental Standards as stated in NEMA publication No. TS 1-1976, Part 2.

Any unit submitted, whose failure has been corrected, shall be retested from the beginning of this stage.

Stage 4 Operational Test

All control and auxiliary equipment shall operate without failure for a minimum of ten consecutive days. If an isolated controller is specified, it shall operate as an isolated controller. If a coordinated system is specified, it shall operate as a total coordinated system with the master and all local controllers operating in all coordinated modes.

If any failure occurs during this stage, all equipment for this stage shall be restarted following completion of repairs.

Equipment Failure Or Rejection

Equipment failures shall be defined as set forth in NEMA Publication No. TS 1-1976. Failure of load switches, detector amplifiers, and conflict monitors shall not result in rejection of the controller or cabinet. However, the Contractor shall stock, as replacements, approximately 30 percent more than the total for these three items. All excess material shall remain the property of the Contractor following completion of all tests.

If a failure occurs during Stages 3 or 4, repairs shall be made and completed within ten working days following notification of the malfunction. The Contractor shall have the option of making onsite repairs or repair them at a site selected by the Contractor. Failure to complete repairs within the allotted time shall result in rejection of the controller or cabinet assembly under test.

1 A total of two failures will be allowed from the start of Stage 3 to the end of
2 Stage 4. If three failures occur during this time period, the equipment will be
3 rejected. New equipment of different serial numbers submitted as replacement
4 shall be received by the NW Region Signal Shop for testing under Stage 3
5 within ten working days following notification of rejection. Failure to meet this
6 requirement within the allotted time will result in rejection of the entire system.
7 Software errors will be considered as failures and, if not corrected within ten
8 working days, the entire system will be subject to rejection. Following rejection
9 of any equipment, the Contractor shall be responsible for all costs incurred.
10 This shall include but not be limited to all shipping costs.

11
12 When the traffic control program is supplied by the State, the Contractor shall
13 prove that any failures are, in fact, caused by that program and not the
14 hardware.

15
16 All component or system failures, except load switches and detector amplifiers,
17 shall be documented. This documentation shall be submitted prior to
18 commencing the test or stage in which the failure was found and shall provide
19 the following information:

- 20
21 a. A detailed description of the failure.
22 b. The steps undertaken to correct the failure.
23 c. A list of parts that were replaced, if any.
24

25 Upon completion of the tests, the equipment will be visually inspected. If
26 material changes are observed which adversely affect the life of the
27 equipment, the cause and conditions shall be noted. The Contractor will
28 immediately be given notice to correct these conditions. If not repaired within
29 ten working days of notification, the equipment will be subject to rejection. A
30 final accounting shall be made of all equipment prior to approval.

31
32 All failed or rejected equipment shall be removed from the NW Region Signal
33 Shop within three working days following notification; otherwise, the failed or
34 rejected equipment will be returned, freight collect, to the Contractor.

35
36 Following final approval by the NW Region Signal Shop, all equipment shall be
37 removed from the NW Region Signal Shop and delivered to sites as
38 designated elsewhere in this contract.

39
40 **Guarantees**

41 The supplier shall furnish to the State any guarantee or warranty furnished as
42 a normal trade practice in connection with any equipment supplied for this
43 contract.

44
45 200314A1.GR8
46 **(March 13, 1995)**
47 **Testing**

48 All signal control equipment shall be tested at the Washington State Department of
49 Transportation Materials Laboratory located in Tumwater, Washington, prior to final
50 delivery. The tests shall check the operation of each individual component as well
51 as the overall operation of the system.
52

1 The Contractor shall designate a qualified representative for these tests.
2 Notification of this representative shall be submitted for approval, in writing, to the
3 State Materials Laboratory, 14 calendar days prior to any equipment deliveries.
4 The Engineer shall also receive a copy of this notification, which includes the
5 representative's name, address, and telephone number. All communications and
6 actions regarding testing of all equipment submitted to the State Materials
7 Laboratory shall be made through this representative. These communications and
8 actions shall include, but not be limited to, the following:
9

10 All notifications of failure or rejection, demonstration of the equipment, and the
11 return of rejected equipment.
12

13 The State Materials Laboratory testing process will consist of the following four
14 separate stages:
15

- 16 a. Delivery and Assembly
- 17 b. Demonstration and Documentation
- 18 c. Performance Test
- 19 d. Operational Test
20

21 Testing will follow in the correct order with no time gaps between stages unless
22 mutually agreed upon by the Contractor and State Materials Laboratory.
23

24 **Stage 1 Delivery Assembly**

25 All components for the complete traffic control systems, including the
26 necessary test equipment, shall be assembled and ready for demonstration
27 within ten working days of delivery to the Materials Laboratory. The systems
28 shall simulate the operations as installed in the field.
29

30 Equipment and prerequisites necessary to complete this stage shall include:
31

- 32 a. Detection Simulator:
33 The detection simulator shall provide at least one detector per phase
34 and variable traffic volumes. One simulator shall be required for
35 every two controllers tested.
36
- 37 b. Communications Network:
38 Locations, specified for coordinating communications equipment and
39 cable, shall be completely wired to provide an operational
40 communications system between all local and master controllers.
41

42 The Contractor shall provide labor, equipment, and materials necessary to
43 assemble all control equipment complete and ready for demonstration.
44 Materials and equipment used for this stage that are not required for field
45 installation shall remain the property of the Contractor. Failure to complete this
46 stage within ten working days will result in rejection of the entire system.
47

48 **Stage 2 Demonstration and Documentation**

49 This stage shall be completed within seven working days following the
50 completion of Stage 1. Failure to do so shall result in rejection of the entire
51 shipment.
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All documentation shall be furnished with the control equipment prior to the start of testing. If corrections to any document are deemed necessary by the State, the Contractor shall submit this updated version prior to the final approval by the State Materials Laboratory. The documents to be supplied shall consist of or provide the following:

- a. A Complete accounting of all the control and test equipment required.
- b. A complete set of documents which shall include:
 - 1. Serial numbers when applicable.
 - 2. Written certification that equipment of the same make and model has been tested according to NEMA Environmental Standards and Test Procedures, and has met or exceeded these standards. The certificate shall include equipment model number and where, when, and by whom the tests were conducted. This certificate shall accompany each shipment of controllers.
 - 3. Reproducible mylar wiring diagrams and two blue-tone prints for each controller and cabinet supplied. The sheet size shall be 24 inches by 36 inches.
 - 4. Wiring diagrams for all auxiliary equipment furnished. One set per cabinet.
 - 5. Complete operations and maintenance manuals including complete and correct software listing and flow charts. One set of operations and maintenance manuals per cabinet; at least four but no more than ten. Five sets of software listings and flow charts.
 - 6. Complete operations and maintenance manuals for all auxiliary equipment. One set per cabinet.
- c. A description of the functions and the capabilities of individual components and of the overall control system.
- d. A presentation on how to operate the system.
- e. A complete and thorough demonstration to show that all components of the control system are in good condition and operating properly, and proof that the controller and cabinet are functioning correctly.
- f. Detailed instructions for installing and operating the controller(s), including explanations on the use of all features of the controller(s).
- g. The operational and maintenance manuals for each traffic signal controller supplied including as a minimum, but not to be limited to the following:

1. Detailed instructions for maintaining all hardware components, controller, and auxiliary equipment.
2. A complete parts list detailing all manufacturer's identification codes.
3. Detailed wiring diagrams and schematics indicating voltage levels and pictorial description, part name, and location for all hardware components, controller, and auxiliary equipment.

The demonstration shall include the following:

- a. Phasing per plans and all phase timing.
- b. Detection including any special detector functions.
- c. Conflict Monitor and Load Switches.
- d. Special Coordination including communication equipment.

This demonstration shall be performed by the Contractor in the presence of State Materials personnel. The Contractor shall supply any item not accounted for within five working days of the accounting. Controllers and cabinets that remain incomplete five working days after notification shall be rejected and returned freight collect to the Contractor.

Stage 3 Unit Performance Test

A minimum of ten working days shall be allowed for one or two cabinet assemblies and five working days for each additional assembly.

The unit performance test will be conducted by State Personnel to determine if each and every controller cabinet assembly complies with NEMA Environmental Standards as stated in NEMA publication No. TS 1-1976, Part 2.

Any unit submitted, whose failure has been corrected, shall be retested from the beginning of this stage.

Stage 4 Operational Test

All control and auxiliary equipment shall operate without failure for a minimum of ten consecutive days. If an isolated controller is specified, it shall operate as an isolated controller. If a coordinated system is specified, it shall operate as a total coordinated system with the master and all local controllers operating in all coordinated modes.

If any failure occurs during this stage, all equipment for this stage shall be restarted following completion of repairs.

Equipment Failure Or Rejection

Equipment failures shall be defined as set forth in NEMA Publication No. TS 1-1976. Failure of load switches, detector amplifiers, and conflict monitors shall

1 not result in rejection of the controller or cabinet. However, the Contractor
2 shall stock, as replacements, approximately 30 percent more than the total for
3 these three items. All excess material shall remain the property of the
4 Contractor following completion of all tests.
5
6 If a failure occurs during Stages 3 or 4, repairs shall be made and completed
7 within ten working days following notification of the malfunction. The
8 Contractor shall have the option of making onsite repairs or repair them at a
9 site selected by the Contractor. Failure to complete repairs within the allotted
10 time shall result in rejection of the controller or cabinet assembly under test.
11
12 A total of two failures will be allowed from the start of Stage 3 to the end of
13 Stage 4. If three failures occur during this time period, the equipment will be
14 rejected. New equipment of different serial numbers submitted as replacement
15 shall be received by the Materials Laboratory for testing under Stage 3 within
16 ten working days following notification of rejection. Failure to meet this
17 requirement within the allotted time will result in rejection of the entire system.
18 Software errors will be considered as failures and, if not corrected within ten
19 working days, the entire system will be subject to rejection. Following rejection
20 of any equipment, the Contractor shall be responsible for all costs incurred.
21 This shall include but not be limited to all shipping costs.
22
23 When the traffic control program is supplied by the State, the Contractor shall
24 prove that any failures are, in fact, caused by that program and not the
25 hardware.
26
27 All component or system failures, except load switches and detector amplifiers,
28 shall be documented. This documentation shall be submitted prior to
29 commencing the test or stage in which the failure was found and shall provide
30 the following information:
31
32 a. A detailed description of the failure.
33 b. The steps undertaken to correct the failure.
34 c. A list of parts that were replaced, if any.
35
36 Upon completion of the tests, the equipment will be visually inspected. If
37 material changes are observed which adversely affect the life of the
38 equipment, the cause and conditions shall be noted. The Contractor will
39 immediately be given notice to correct these conditions. If not repaired within
40 ten working days of notification, the equipment will be subject to rejection. A
41 final accounting shall be made of all equipment prior to approval.
42
43 All failed or rejected equipment shall be removed from the Materials
44 Laboratory within three working days following notification; otherwise, the
45 failed or rejected equipment will be returned, freight collect, to the Contractor.
46
47 Following final approval by the State Materials Laboratory, all equipment shall
48 be removed from the State Materials Laboratory and delivered to sites as
49 designated elsewhere in this contract.
50

1 **Guarantees**

2 The supplier shall furnish to the State any guarantee or warranty furnished as
3 a normal trade practice in connection with any equipment supplied for this
4 contract.

5
6 GCTRN.DT1

7 **(NWR March 13, 1995)**

8 **Controller Equipment Training**

9 The Contractor shall provide a minimum of 8 hours training for Contracting Agency
10 personnel. Qualified personnel, mutually agreed upon by the Contracting Agency
11 and Contractor, shall conduct the training. All sessions shall be conducted during
12 Stages 2, 3, and 4 as described under **Testing** in this Special Provision. The
13 Contractor shall notify the Project Engineer, who in turn shall notify the Regional
14 Traffic Engineer, 7 days in advance of the training session. All documentation
15 (maintenance manuals, wiring diagrams, etc.) shall be made available for use in
16 this training session.

17
18 This training shall include, but not be limited to, the following:

- 19
20 1. Operations: (approximately 4 hours in length)
- 21 a. Equipment Energization Procedures
22 b. Utilization of Operator Controls
23 c. Input Procedures
- 24 2. Maintenance: (approximately 4 hours in length)
- 25 a. Hardware Maintenance
26 b. System Trouble Shooting
27 c. Detection of Abnormal Conditions
28 d. Emergency Operating Procedures

29 All participants are assumed to have a basic working knowledge of
30 electronics.

31 Training sessions shall emphasize hands-on training.

32 No compensation shall be made to the Contractor if the "Controller
33 Equipment Training" bid item is cancelled prior to the end of the
34 procurement period, in accordance with Section 1-09.5.

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41 GCSH.DT1

42 **(NWR September 16, 2002)**

43 **Signal Heads**

44 Section 8-20.3(14)B is supplemented with the following:

45 Unless ordered by the Engineer, signal heads shall not be installed at any
46 intersection until all other signal equipment is installed and the controller is in
47 place, inspected, and ready for operation at that intersection, except that the
48 signal heads may be mounted if the faces are covered with a black opaque
49 material.

- 1 The signal head covering material shall be of sufficient size to entirely cover
2 the display. The covering shall extend over all edges of the signal housing and
3 shall be securely fastened at the back.
4
- 5 GC3MHEAD.DT1
6 **(NWR April 3, 1993)**
7 **Optically Programmed Signal Head:**
8 The visibility zone of the optically programmed signal heads shall be set as
9 directed by the Engineer.
10
- 11 GCLOOP.DT1
12 **(NWR December 16, 2002)**
13 **Induction Loop Vehicle Detectors**
14 Section 8-20.3(14)C is supplemented with the following:
15
16 Item 2 is deleted.
17
18 The last two sentences of Item 4 are deleted.
19
20 Item 11 is deleted.
21
- 22 GCRLOOP.DT1
23 **(NWR April 19, 2004)**
24 **Round Loops**
25 Round loops shall be constructed in accordance with the following requirements:
26
27 1. Loop wire shall be No. 14 stranded copper with XHHW or THWN
28 insulation conforming to IMSA 51-7 requirements, encased in 6.35mm
29 outside diameter polyethylene tubing.
30 2. Round sawcuts shall be 6 feet in diameter and shall be constructed using
31 equipment designed for cutting round loops. The equipment shall use a
32 concave, diamond-segmented blade. The sawcuts shall be normal to the
33 pavement surface and shall be a minimum of 0.25 inches wide. The
34 sawcut depth shall be a minimum of 2 5/8 inches and a maximum of 3
35 inches measured at any point along the perimeter, except on bridge
36 decks. Other methods of constructing the round sawcut, such as
37 anchoring a router or flat blade saw, will not be allowed.
38 3. The bottom of the sawcut shall be smooth. No edges created by
39 differences in sawcut depths will be allowed.
40 4. All sawcut corners shall be rounded to a minimum 1.6 inch radius.
41 5. All sawcuts shall be cleaned with a 1000 psi high pressure washer as
42 certified by the manufacturer's label on the machine or as measured by an
43 in line pressure gauge. Wash water and slurry shall be vacuumed out and
44 the sawcut shall be blown dry with compressed air. Sawcutting shall be
45 subject to the requirements set forth in Section 1-07.5(3) and the
46 subsection **Fish And Wildlife and Ecology Regulations** of the Special
47 Provision **LEGAL RELATIONS AND RESPONSIBILITIES TO THE**
48 **PUBLIC.**
49 6. Loops shall be installed after all grinding and prior to paving the final lift of
50 asphalt.
51 7. The loop shall be constructed using four turns of conductor. The
52 conductor shall be installed one turn on top of the previous turn. All turns

- 1 shall be installed in a clockwise direction. The conductors shall be
2 secured to prevent floating with 2 inch lengths of high temperature foam
3 backer rod sized for a snug fit. The backer rod shall be spaced at 2 foot
4 intervals around the perimeter of the sawcut and at corners.
- 5 8. Loop sealant shall be installed in two layers. The first layer shall be
6 allowed to cool before the second layer is applied. Installation of the
7 sealant shall completely encapsulate the loop conductors. A minimum of 1
8 inch of sealant shall be provided between the top of the conductors and the
9 top of the sawcut. The twisted polypropylene rope noted in Standard Plan
10 J-8a is not allowed.
- 11 9. Use of kerosene solvent is prohibited.

12

13 GCEXLP.DT1

14 **(NWR October 14, 1999)**

15 **Existing Traffic Loops**

16 The Contractor shall notify the Area Traffic Engineer through the Engineer a
17 minimum of five working days in advance of pavement removal in the loop areas.

18

19 If the Engineer suspects that damage to any loop may have resulted or believes it
20 possible that an existing loop is not operating adequately, the Engineer may order
21 the Contractor to perform the field tests specified in Section 8-20.3(14)D. The test
22 results shall be recorded and submitted to the Engineer. Loops which fail any of
23 these tests shall be replaced.

24

25 If advance loops are replaced, they shall be installed immediately ahead of or
26 behind the existing loops. The Contractor shall avoid cutting through the existing
27 loop or lead-in.

28

29 If replacement loops are not operational within 48 hours, the Contractor shall install
30 and maintain interim vehicle detection at no additional cost to the Contracting
31 Agency until the permanent loops are in place. The type of interim detection
32 furnished shall be approved by the Engineer prior to installation.

33

34 GCILLCT.DT1

35 **(NWR March 8, 2004)**

36 **Test for Induction Loops and Lead-in Cable**

37 Section 8-20.3(14)D is supplemented with the following:

38

39 An inductance level below 75 microhenries is considered a failure for a round loop.

40

41 Test A - The resistance shall not exceed values calculated using the given formula.

42

43 Resistance per 1000 ft of #14 AWG, $R = 3.16 \text{ ohms} / 1000 \text{ ft}$

44

45
$$R = \frac{3.16 \times \text{distance of lead-in cable (ft)}}{1000 \text{ ft}}$$

46

47

48 GEMES.DT1

49 **Measurement**

50 Section 8-20.4 is supplemented with the following:

51

1 GEMESA.DT1
2 (NWR November 16, 1995)
3 Replacement of existing loops will be measured per each complete installation.
4
5 GEMESB.DT1
6 (NWR August 5, 1996)
7 Boring casing of the kind and diameter specified will be measured by the linear foot for
8 the actual neat line length in place.
9
10 GEMESC.DT1
11 (NWR February 5, 2002)
12 Directional boring will be measured by the linear foot for the length of the boring tunnel.
13
14 GEMESD.DT1
15 (NWR February 5, 2002)
16 When shown as lump sum in the Plans or in the Proposal as Signal Interconnect
17 System, no specific unit of measurement will apply, but measurement will be for the sum
18 total of all items for a complete system to be furnished and installed.
19
20 GEMESE.DT1
21 (NWR September 16, 2002)
22 When shown as lump sum in the Plans or in the proposal as illumination system ____,
23 traffic signal display and detection system ____, traffic signal control system ____, or
24 traffic data accumulation and ramp metering system ____, no specific unit of
25 measurement will apply, but measurement will be for the sum total of all items for a
26 complete system to be furnished and installed.
27
28 GEPAY.DT1
29 **(NWR December 16, 2002)**
30 **Payment**
31 Section 8-20.5 is revised to read:
32
33 Payment will be made in accordance with Section 1-04.1, for each of the following bid
34 items that are included in the proposal:
35
36 "Illumination System ____", lump sum.
37 "Traffic Signal Display and Detection System ____", lump sum.
38 "Traffic Signal Control System ____", lump sum.
39 "Traffic Data Accumulation and Ramp Metering System____", lump sum.
40 The lump sum contract price for "Illumination System ____", "Traffic Signal Display
41 and Detection System ____", "Traffic Signal Control System ____", "Traffic Data
42 Accumulation and Ramp Metering System____", shall be full pay for the
43 construction of the complete electrical system, modifying existing systems, or both,
44 as shown in the Plans and herein specified including excavation, backfilling,
45 concrete foundations, conduit, wiring, restoring facilities destroyed or damaged
46 during construction, salvaging existing materials, and for making all required tests.
47 All additional materials and labor, not shown in the Plans or called for herein and
48 which are required to complete the electrical system, shall be included in the lump
49 sum contract price.
50
51 "Conduit Pipe ____ In. Diam.", per linear foot.

1 The unit contract price per linear foot for "Conduit Pipe ____ In. Diam." shall be full
2 pay for furnishing all pipe, pipe connections, elbows, bends, caps, reducers,
3 conduits, and unions; for placing the pipe in accordance with the above provisions,
4 including all excavation or jacking required, backfilling of trenches and pits,
5 restoration of vegetation disturbed by the operation, chipping of pavement, and
6 bedding of the pipe; and all other work necessary for the construction of the
7 conduit, except that when conduit is included on any project as an integral part of
8 an illumination or traffic signal system and the conduit is not shown as a pay item, it
9 shall be included in the lump sum price for the system shown.

10
11 All costs for installing conduit containing both signal and illumination wiring shall be
12 included in the contract prices for the signal system.

13
14 All costs for installing junction boxes containing both illumination and signal wiring
15 shall be included in the contract prices for the signal system.

16
17 **GEPAYA.DT1**
18 (NWR December 15, 2003)
19 Except for the installation and testing of traffic loops as described under **Existing**
20 **Traffic Loops**, all costs for the installation and testing of traffic loops shall be
21 included in the lump sum contract price for "Traffic Signal Display and Detection
22 System".
23
24 "Loop Replacement Type ____", per each.
25 When traffic loops are replaced as described under **Existing Traffic Loops**, all
26 costs for replacement, along with associated testing of the new loops, shall be
27 included in the unit contract price per each for "Loop Replacement Type ____".
28
29 "Force Account Loop Testing", by force account.
30 When existing loops are tested as described under **Existing Traffic Loops**,
31 payment shall be by force account, as provided in Section 1-09.6.
32
33 For the purpose of providing a common proposal for all bidders, the Contracting
34 Agency has entered an amount for the item "Force Account Loop Testing" in the
35 proposal to become a part of the total bid by the Contractor.

36
37 **GEPAYB.DT1**
38 (NWR April 3, 1996)
39 All costs for adjustment of junction boxes, both to the final grade and any grade
40 adjustments required for the various construction stages proposed in the Contract,
41 or for alternative stages proposed by the Contractor, shall be included in the lump
42 sum contract price for the associated electrical system.

43
44 **GEPAYC.DT1**
45 (NWR April 3, 1996)
46 All costs for conduit, junction boxes, and associated hardware and fittings installed
47 on or within a structural item (wall, bridge, or barrier) shall be included in the
48 respective lump sum bid item for work on the associated electrical system.

49
50 **GEPAYD.DT1**
51 (NWR May 15, 2000)
52 "Boring Steel Casing Pipe ____ In. Diam.", per linear foot.

1 The unit contract price per linear foot for "Boring Steel Casing Pipe ____ In. Diam."
2 shall be full pay for furnishing all associated material and for all work associated
3 with installation of the casing pipe.
4

5 **GEPAYE.DT1**

6 (NWR December 16, 2002)
7 "Directional Boring", per linear foot.

8 The unit contract price per linear foot for "Directional Boring", shall be full pay for
9 furnishing all material associated with the directional boring, with the exception of
10 conduit, and for all work associated with the directional boring.
11

12 **GEPAYF.DT1**

13 (NWR February 5, 2002)
14 "Signal Interconnect System", lump sum.
15

16 The lump sum contract price for "Signal Interconnect System" shall be full pay for
17 the construction of the complete signal interconnect system, modifying the existing
18 signal interconnect system, or both, as shown in the Plans and as specified for
19 other electrical systems in this section.
20

21 All costs for installing conduit and junction boxes containing both signal and
22 interconnect wiring shall be included in the contract prices for the associated signal
23 system.
24

25 **GEPAY1.DT1**

26 (NWR March 13, 1995)
27 The construction signs used during signal turn-on will be paid as part of
28 "Construction Signs Class A".
29

30 **20.GR8**

31 **ILLUMINATION, TRAFFIC SIGNAL SYSTEMS, AND ELECTRICAL**

32
33 **FLOOPREP.DT1**

34 **(NWR March 8, 2004)**

35 **Description**

36 Section 8-20.1 is supplemented with the following:
37

38 \$1\$
39

40 **Materials**

41 Section 8-20.2 is supplemented with the following:
42

43 ***Equipment List and Drawings***

44 Section 8-20.2(1) is supplemented with the following:
45

46 Manufacturer's data for materials proposed for use in the contract which require
47 approval shall be submitted in one complete package.
48

49 ***Junction Boxes***

50 Section 9-29.2 is supplemented with the following:
51

52 **Type 4, 5 and 6 Junction Boxes**

Type 4, 5 and 6 junction boxes shall meet the following requirements:
Concrete shall have a minimum compressive strength of 4000 psi. The steel frame and lid shall be painted with a shop applied, inorganic zinc primer in accordance with Section 6-07.3.

Material shall conform to the following:

Concrete	Section 6-02
Reinforcing Steel	Section 9-07
Lid	ASTM A786 diamond plate rolled from plate Complying with ASTM A572, Grade 50 or ASTM A588, both with min. CVN toughness of 20 ft-lb at 40 F
Frame and Stiffener Plates	ASTM A572, Grade 50 or ASTM A588, both with min. CVN toughness of 20 ft-lb at 40F
Handle	ASTM A36 steel
Anchors (studs)	Section 9-06.15
Bolts, Nuts, Washers	ASTM F593 or A193, type 304 or 316

The lid stiffener plates shall bear on the frame. Mill so that there is full even contact, around the perimeter, between the bearing seat and lid stiffener plates, after fabrication of the frame and lid. The bearing seat and lid perimeter bar shall be free from loose mill scale, burrs, dirt and other foreign debris that would prevent solid seating. Bolts and nuts shall be liberally coated with anti-seize compound. Bolts shall be installed snug tight. The bearing seat and lid perimeter bar shall be machined to allow a minimum of 75% of the bearing areas to be seated with a tolerance of 0.0 to 0.005 inches measured with a feeler gage. The bearing area percentage will be measured for each side of the lid as it bears on the frame.

Type 4, 5 and 6 junction boxes and lids shall have a vertical load strength of 46,000 pounds without permanent deformation and 60,000 pounds without failure.

For each type of junction box (type 4, 5 and 6) to be installed, the Contractor shall provide a certified test report, prepared by an independent testing lab, which documents results of testing done by the independent testing lab for the manufacturer. The test report shall certify that the boxes meet or exceed the loading requirements and shall document the results of the load test listed below. The independent testing lab shall be approved by the State Materials Engineer and shall be located within the State of Washington. Representatives of the State Materials Lab shall witness the test and sign the test report. The Contractor shall give the Engineer 30 days notice prior to testing. Three copies of the test report shall be provided to the Engineer prior to acceptance.

Boxes shall be load tested to 46,000 pounds and then to 60,000 pounds. The test load shall be applied in both longitudinal and transverse orientations. At each interval the test box shall be inspected for lid deformation, failure of the lid/frame welds, vertical and horizontal displacement of the lid frame, cracks, and concrete spalling. The test load shall be applied uniformly through a 10 inch x 20 inch x 1 inch steel plate centered on the frame.

Junction boxes meeting the 46,000-pound requirement shall not exhibit any of the following deficiencies:

1. Permanent deformation of the lid or any impairment to the function of the lid.
2. Vertical or horizontal displacement of the lid frame.
3. Cracks wider than 0.012 inches that extend 12 inches or more.
4. Fracture or cracks passing through the entire thickness of the concrete.
5. Spalling of the concrete.

Junction boxes meeting the 60,000-pound requirement shall exhibit the following:

1. The lid is operational.
2. The lid is securely fastened.
3. The welds have not failed.
4. Permanent dishing or deformation of the lid is ¼ inch or less.
5. No buckling or collapse of the box.

Conductors, Cable

Section 9-29.3 is supplemented with the following:

Item 7 is revised to read as follows:

7. Two conductor shielded (2CS) cable shall have No. 14 AWG (minimum) conductors and shall conform to I.M.S.A. specification No. 50-2.

Item 8 is revised to read as follows:

8. Detector loops shall use No. 14 AWG stranded copper conductors, and shall conform to IMSA Specification 51-7, with cross-linked polyethylene (XLPE) insulation encased in a polyethylene outer jacket (PE tube).

Traffic Signal Splice Material

Section 9-29.12(2) is supplemented with the following:

Induction loop splices shall be either mastik type, or moisture resistant two way heat shrink type meeting Mil Spec I-23053, or re-enterable type with semi-hardening epoxy filling compound that remains semi-flexible enclosed in a re-enterable rigid mold with end cap seals.

Vehicle Detector

Section 9-29.18 is supplemented with the following:

Loop sealant for use in ACP pavement shall be one of the following:

1. RAI Pro-Seal 6006EX
2. QCM EAS-14
3. 3M Black 5000

Loop sealant for use on concrete bridge decks and PCC pavement shall be one of the following:

1. 3M Black 5000
2. Gold Label Flex 1P
3. QCM EAS-14

Installation shall conform to the manufacturer's recommendations.

Construction Requirements

General

Section 8-20.3(1) is supplemented with the following:

Traffic Loops

The Contractor shall notify the NW Region Traffic Signal Operations group through the Engineer a minimum of five working days in advance of pavement removal in the loop areas.

If replacement loops are not operational within 48 hours, the Contractor shall install and maintain interim vehicle detection at no additional cost to the Contracting Agency until the permanent loops are in place. The type of interim detection furnished shall be approved by the Engineer prior to installation.

Junction Boxes

Section 8-20.3(6) is supplemented with the following:

Wiring shall not be pulled into any conduit until all associated junction boxes have been adjusted to or installed in their final grade and location, unless installation is necessary to maintain system operation. If wire is installed for this reason, sufficient slack shall be left to allow for future adjustment.

All type 1, 2, or 3 junction boxes within the traveled way or shoulders shall be replaced with type 4, 5 or 6 junction boxes or be relocated off of the traveled way and shoulder as indicated in the plans. Both existing and new junction boxes shall be adjusted to be flush both with the finished grade and with grade during the various construction stages proposed in the Contract.

Adjustments involving raising or lowering the junction boxes shall require conduit modification if the resultant clearance between top of conduit and the junction box lid becomes less than 6 inches or more than 8 inches in accordance with Standard Plan J-11a. Wiring shall be replaced if sufficient slack as specified in Section 8-20.3(8) is not maintained.

The six-inch gravel pad required in Standard Plan J-11a shall be maintained. When existing junction boxes do not have this gravel pad, it shall be installed as part of the adjustment to finished grade.

All voids resulting from the adjustment shall be backfilled and compacted in accordance with Section 2-09.3(1)E.

Prior to construction of finished grade, if junction boxes are installed or adjusted, pre-molded joint filler for expansion joints may be placed around the junction boxes. The joint filler shall be removed prior to adjustment to finished grade.

Type 4, 5 and 6 junction boxes shall be installed in accordance with the following:

1. Excavation and backfill shall be in accordance with Section 2-09. Excavation for junction boxes shall be sufficient to leave 1 foot in the clear between their outer surface and the earth bank.
2. The junction box shall be installed on a level 6-inch layer of crushed surfacing top course, in accordance with 9-03.9(3), placed on a compacted or undisturbed foundation. The crushed surfacing shall be compacted in accordance with Section 2-09.3(1)E.
3. After installation, the lid shall be kept bolted down during periods when work is not actively in progress at the junction box.
4. Before closing the lid, the lid and the frame shall be thoroughly brushed and cleaned of all debris. There shall be absolutely no visible dirt, sand or other foreign matter between the bearing surfaces.
5. When the lid is closed for the final time, a liberal coating of anti-seize compound shall be applied to the bolts and nuts and the lid shall be securely tightened.
6. Hinges shall be located on the side of the box, which is nearest to adjacent shoulder. Hinges shall allow the lid to open 180 degrees.

Wiring

Section 8-20.3(8) is supplemented with the following:

All splices shall be made in the presence of the Engineer.

Induction Loop Vehicle Detectors

Section 8-20.3(14)C is supplemented with the following:

Item 2 is deleted.

The last two sentences of Item 4 are deleted.

Item 11 is deleted.

Loop Replacement

Traffic loops shall be replaced where shown in the Plans or where indicated by the Engineer.

If advance loops are replaced, they shall be installed immediately ahead of or behind the existing loops. The Contractor shall avoid cutting through the existing loop or lead-in to minimize downtime.

Round Loops

Round loops shall be constructed in accordance with the following requirements:

1. Loop conductor shall conform to these Special Provisions. Loop lead-in cable shall conform to Section 9-29.3.

2. Round sawcuts shall be 6 feet in diameter and shall be constructed using equipment designed for cutting round loops. The equipment shall use a concave, diamond-segmented blade. The sawcuts shall be vertical and shall be a minimum of 0.25 inch wide. The sawcut depth shall be a minimum of 2 5/8 inches and a maximum of 3 inches measured at any point along the perimeter, except on bridge decks. Other methods of constructing the round sawcut, such as anchoring a router or flat blade saw, will not be allowed.
3. The bottom of the sawcut shall be smooth. No edges created by differences in sawcut depths will be allowed.
4. All sawcut corners shall be rounded to a minimum 1.6 inch radius.
5. All sawcuts shall be cleaned with a 1000 psi high pressure washer as certified by the manufacturer's label on the machine or as measured by an in line pressure gauge. Wash water and slurry shall be vacuumed out and the sawcut shall be blown dry with compressed air. Sawcutting shall be subject to the requirements set forth in Section 1-07.5(3) and the subsection **Fish And Wildlife and Ecology Regulations** of the Special Provision **LEGAL RELATIONS AND RESPONSIBILITIES TO THE PUBLIC**.
6. Loops shall be installed after all grinding and prior to paving the final lift of asphalt.
7. The loop shall be constructed using 4 turns of conductor. The conductor shall be installed one turn on top of the previous turn. All turns shall be installed in a clockwise direction. The conductors shall be secured to prevent floating with 2 inch lengths of high temperature foam backer rod sized for a snug fit. The backer rod shall be spaced at 2 foot intervals around the perimeter of the sawcut and at corners.
8. Loop sealant shall be installed in 2 layers. The first layer shall be allowed to cool before the second layer is applied. Installation of the sealant shall completely encapsulate the loop conductors. A minimum of 1 inch of sealant shall be provided between the top of the conductors and the top of the sawcut. The twisted polypropylene rope noted in Standard Plan J-8a is not allowed.
9. Use of Kerosene solvent is prohibited.

Test for Induction Loops and Lead-in Cable

Section 8-20.3(14)D is supplemented with the following:

An inductance level below 75 microhenries is considered a failure for a round loop.

If grinding occurs in the area of existing induction loops and the Engineer suspects that damage to any loop may have resulted or believes it possible that a loop is not operating adequately, the Engineer may direct the Contractor to perform the field tests specified in this section. The test results shall be recorded and submitted to the Engineer. Loops which fail any of the specified tests shall be replaced.

Measurement

Section 8-20.4 is supplemented with the following:

Replacement of existing loops will be measured per each complete installation.

Payment

Section 8-20.5 is supplemented with the following:

Payment will be made for the following bid items:

"Loop Replacement Type R1", per each.

"Loop Replacement Type R2", per each.

"Loop Replacement Type R3", per each.

"Force Account - Loop Testing".

"Force Account - Adjust Junction Box".

"Force Account – Replace Junction Box."

Payment for the testing of existing traffic loops, adjustment of junction boxes, and replacement of junction boxes shall be by force account, as provided in Section 1-09.6.

For the purpose of providing a common proposal for all bidders, the Contracting Agency has entered an amount for the items "Force Account - Loop Testing", "Force Account - Adjust Junction Box" and "Force Account – Replace Junction Box" in the bid proposal to become a part of the total bid by the Contractor.

All costs for the replacement of traffic loops, along with associated testing of new loops, shall be included in the contract price for "Loop Replacement Type ____", per each.

20.GR8

ILLUMINATION, TRAFFIC SIGNAL SYSTEMS, AND ELECTRICAL

FTEMPSIG.DT1

(NWR March 8, 2004)

Description

Section 8-20.1 is supplemented with the following:

This work shall include furnishing and installing all materials and equipment necessary to complete an in-place temporary signal system. The Contractor shall operate and maintain the temporary signal system.

Materials

Section 8-20.2 is supplemented with the following:

Equipment List and Drawings

Section 8-20.2(1) is supplemented with the following:

The Contractor shall submit the following pertaining to the temporary signal system: timing plan, manufacturer's data, type of power supply, and method of vehicle detection. The submittal package shall be routed through the Engineer and to the District Traffic Engineer for review and approval.

These items shall be submitted in one complete package.

Signal System

The temporary signal system shall be capable of operating on AC, generator, or battery power.

1 **Conduit**

2 Section 9-29.1 is supplemented with the following:

3
4 **Conduit Coatings**

5 Conduit fittings for steel conduit shall be coated with galvanizing repair paint in the
6 same manner as conduit couplings. Electroplated fittings are not allowed.

7
8 **Conductors, Cable**

9 Section 9-29.3 is supplemented with the following:

10
11 Conductors used to connect the display units shall meet the portable signal system
12 manufacturer's requirements.

13
14 **Traffic Signal Controllers**

15 Section 9-29.13 is supplemented with the following:

16
17 The temporary signal controller shall be capable of providing a *** \$\$1\$\$ *** -
18 phase operation. The all-red clearance interval shall be operator-programmable up
19 to 255 seconds and adjustable in increments of 1 second. The controller shall be
20 capable of traffic-actuated operation.

21
22 **Vehicle Detector**

23 Section 9-29.18(1) is supplemented with the following:

24 *** \$\$2\$\$ ***

25
26
27 **Construction Requirements**

28 **General**

29 Section 8-20.3(1) is supplemented with the following:

30
31 **Removal of Temporary Signal System**

32 The temporary signal system shall remain the property of the Contractor and shall
33 be dismantled and removed from the job site when the need for one-way traffic
34 control is over.

35
36 **Conduit**

37 Section 8-20.3(5) is supplemented with the following:

38 Conduit installed at the following locations shall be Rigid Galvanized Steel:

39 Within railroad right of way unless otherwise specified in the contract.

40 All runs within slip form structures.

41 Conduit risers except as otherwise required by serving utilities.

42 Surface mounted conduit other than conduit risers.

43
44
45 Couplings in cabinet foundations shall be Rigid Galvanized Steel. The stubouts
46 above the couplings shall be Rigid Galvanized Steel with grounding bushings.

Conduit installed using the directional boring method shall be UL listed High Density Polyethylene (HDPE) Schedule 80 or Rigid Galvanized Steel. Connections to HDPE conduit shall be made with an approved mechanical coupler.

At all other locations, unless otherwise specified in the Plans, conduit shall be PVC or Rigid Galvanized Steel.

Conduit shall be laid to a minimum depth of:

48 inches below the bottom of ties under rail road tracks.

24 inches below the curb grade in the sidewalk area.

24 inches below finished grade in all other areas.

Conduit stub-outs within cabinet foundations shall be placed so that they do not interfere with cabinet installation. Modification of the cabinet to accommodate stub-out placement is not allowed.

A pull string rated for 200 lbs. or greater shall be installed in all spare conduit.

All conduit including spare conduits shall be installed with bushings. Rigid Galvanized Steel conduit shall be installed with insulated grounding bushings. PVC conduit shall be installed with molded one-piece bell end bushings.

All conduits including spare conduits shall be installed with plugs, which shall not be removed until installation of conductors or pull string. Upon installation of wiring, conduit shall be sealed with duct seal. Upon installation of the pull string, spare conduit shall be plugged

Conduit between light standards, PPB, PS or type I poles and the nearest junction box shall be the diameter specified in the Plans. Larger size conduit is not allowed at these locations.

Spacing of unistrut type channel supports for surface mounted conduit shall not exceed 5 feet.

Where Rigid Galvanized Steel conduit is installed:

Insulated grounding end bushings shall have standard threading, which extends around the entire circumference of the bushing.

Where PVC conduit is installed:

Conduit shall be schedule 40, with the exception that roadway crossings, and service lateral runs shall be schedule 80. The same schedule and type of conduit shall be used for the entire length of the run from outlet to outlet and from HDPE conduit crossing the roadway to the nearest junction box.

Eighteen-inch radius elbows shall be used for conduit of 2-inch nominal diameter or less.

1 Standard sweep elbows shall be used for conduit with greater than 2-inch
2 nominal diameter unless otherwise specified in the Plans.
3
4 With the exception of connections to HDPE conduit, joints shall be connected
5 with medium grade gray cement solvent applied per the manufacturer's
6 recommendations.
7
8 In conduit less than 2-inch nominal diameter, pull ropes for wire installation
9 shall be not less than ¼ inch diameter. In conduit of 2 inch nominal diameter
10 or larger, pull ropes for wire installation shall be not less than ½ inch diameter.
11
12 Trenches located within paved roadway areas shall be backfilled with 3 inches of
13 sand over the conduit, followed by controlled density fill meeting the requirements
14 of Section 2-09.3(1)E. Unless otherwise indicated in the Plans, the controlled
15 density fill shall be placed level to, and 3 inches below, the surface of the remaining
16 pavement, followed by 3 inches of paving material that matches the existing
17 material.
18
19 On new construction, conduit shall be placed prior to the placement of base course
20 pavement.
21

22 **Wiring**

23 Section 8-20.3(8) is supplemented with the following:
24

25 At each junction box, all illumination wires, power supply wires, and communication
26 cable shall be labeled with a PVC marking sleeve. For illumination and power
27 supply circuits the sleeve shall bear the circuit number. For communication cable
28 the sleeve shall be marked "Comm."
29

30 **Service**

31 Section 8-20.3(10) is supplemented with the following:
32

33 The Contractor shall arrange for electrical power with the serving utility if AC units
34 are furnished.
35

36 **Field Test**

37 Section 8-20.3(11) is supplemented with the following:
38

39 In lieu of testing, the Contractor shall supply verification that the temporary signal
40 system is operational and capable of receiving detector inputs for actuated control.
41

42 A qualified representative from the Contractor's portable signal supplier shall be
43 present during the turn-on.
44

45 All signs, pavement markings, channelization, control devices, and warning lights
46 shall be in place prior to turn-on.
47

48 **Signal Systems**

49 Section 8.20.3(14) is supplemented with the following:
50

51 **Operation**

52 The temporary signal system shall provide traffic-actuated operation.

1
2 **Installation**
3 The Contractor shall install the temporary signal system in accordance with the
4 Traffic Control Plan furnished with this contract.
5
6 **Detection**
7 An approved method of vehicular detection for fully-actuated operation is required.
8
9 The Contractor shall be responsible for maintaining the temporary system,
10 including vehicle detection, on a 24-hour basis for the duration of the one-way
11 operation.
12
13 If the signal system should fail for any reason, the Contractor shall be responsible
14 for providing emergency traffic control while repairs are made.
15
16 Repairs shall be made within 48 hours of failure. Should repairs require more than
17 48 hours, the Contractor shall make arrangements to furnish substitute signal units.
18
19 **Signal Controllers**
20 Section 8-20.3(14)A is supplemented with the following:
21
22 The Contractor shall input only controller timings previously approved by the
23 Engineer.
24
25 **Signal Heads**
26 Section 8-20.3(14)B is supplemented with the following:
27
28 Signal displays shall be installed in conformance with MUTCD requirements at
29 each end of the work zone. The displays shall be mounted on post or mast arm
30 assemblies. A minimum of two signal displays per approach are required.
31
32 **Measurement**
33 Section 8-20.4 is supplemented as follows:
34
35 The cost to furnish and maintain the temporary traffic signal system shall be bid and
36 paid for on a *** \$\$3\$\$ *** basis.
37
38 **Payment**
39 Section 8-20.5 is supplemented as follows:
40
41 The *** \$\$4\$\$ *** contract price for "Temporary Signal System" shall be full pay for the
42 system as described, including emergency traffic control.
43
44 The required signs, pavement markings and channelizing devices shall be paid for by
45 other traffic control payment items set up for this contract.
46